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SEVENTH ANNUAL MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

ASSOCIATION,

HELD AT

The Narragansett Hotel, Providence, R. I.,

SEPTEMBER 8TH, 9TH & 10TH, 1885.

BROOKLYN:
EAGLE BOOK AND JOB PRINTING DEPARTMENT.
1885.

SEVENTH ANNUAL MEETING

OF THE

National Telephone Exchange Association,

HELD AT THE

NARRAGANSETT HOTEL, PROVIDENCE, R. I.

SEPTEMBER 8th, 9th and 10th, 1885.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11 o'clock A. M., the President, Morris F. Tyler, of New Haven, in the chair, and W. D. Sargent, of Brooklyn, Secretary.

The Chair opened the meeting as follows:

THE PRESIDENT—The Association will come to order. I have the pleasure, gentlemen, to announce that Governor Howard, President of the Providence Telephone Company, wishes to say a word to the Convention before the opening of our business.

ADDRESS OF EX-GOVERNOR HENRY HOWARD.

MR. PRESIDENT AND GENTLEMEN—In behalf of the Providence Telephone Company, and voicing, as I am sure I may, the sentiment of our community, I extend to you a sincere and a cordial welcome to our city and our State. Remembering, as I do with peculiar pleasure, the character of the Convention as it was made up at Cincinnati two years ago, and recalling the impression

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which was made upon my mind as to the importance of the interests represented by you and the intelligence exhibited by those who were prominent in the Convention at that time, I feel that I ought to say something more than a word of welcome. I want to say, gentlemen, that we are not only glad to see you here to-day, but that we feel that we owe you a debt of gratitude for taking note of our little State and accepting the invitation which I formally extended at that time, and honoring us by your attendance. Words of welcome are so often nothing more than a mere form of words, that I feel that I can hardly impress upon you how deeply I appreciate the honor you have conferred upon us. You represent a great and a growing interest, and I am sure that our entire community will be benefited by the discussions in which you are about to participate. I cannot extend the freedom of the city in any formal manner, but I know our citizens will be glad to see you at their workshops and at their homes. I hope you will make free with their invitations, and that you will carry away with you pleasurable recollections of our little State. In behalf of the Providence Telephone Company I extend a special invitation now. I wish to tender to you the hospitalities of an excursion down what we are in the habit of terming " our beautiful bay." We have arranged to have the steamer " Philadelphia " placed at your disposal on the afternoon of Thursday, at 1 o'clock. The sail will probably occupy about four hours. It is our purpose to return you here at 5 o'clock in the afternoon. We ask you, therefore, that you will make arrangements to omit any matters of a business character for that afternoon. I must take occasion to say, lest my engagements in New York should prevent my return, as I fear they may, that I am greatly disappointed in the apprehension that I may not be able to join you, but that if I am absent my representative will point out to you all the objects of interest. I wish you, gentlemen, a very agreeable Convention and a safe return to your homes. (Applause.)

THE PRESIDENT—Gentlemen of the Association, I think the Chair is justified in tendering your thanks to the Providence Telephone Company, through Gov. Howard, for their invitation, and in accepting the same on your behalf.

Gentlemen, the first thing in order is the calling of the roll of membership. As the membership consists of companies, those who are here will please answer whether such and such a company is represented or not, and will afterwards, as soon as they can, conveniently bring or send up to the Secretary's desk the personal cards of the representatives of the company.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session.

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH CO.—Edward J. Hall, Jr., General Manager.

BELL TELEPHONE CO., of Buffalo, N. Y.—S. H. Cowles, General Manager.

BELL TELEPHONE CO., of Missouri, St. Louis, Mo.—George F. Durant, General Manager.

CENTRAL DISTRICT AND PRINTING TELEGRAPH CO., Pittsburgh, Pa.—Henry Metzger, General Manager.

CENTRAL PENNSYLVANIA TELEPHONE AND SUPPLY CO., Williamsport, Pa.—R. M. Bailey, General Manager.

CHICAGO TELEPHONE CO., Chicago, Ill.—C. N. Fay, General Manager; B. E. Sunny, Superintendent.

CITY AND SUBURBAN TELEGRAPH ASSOCIATION, Cincinnati, O.—George N. Stone, Vice-President and General Manager.

CHESAPEAKE AND POTOMAC TELEPHONE CO., Washington, D. C.—Samuel M. Bryan, General Manager; A. Wilson, Jr., Superintendent.

CENTRAL NEW YORK TELEPHONE AND TELEGRAPH CO., Utica, N. Y.—H. L. Storke, President; C. A. Nicholson, General Manager.

EAST TENNESSEE TELEPHONE CO., New York City.—D. I. Carson, Secretary.

EMPIRE STATE TELEPHONE AND TELEGRAPH CO., Auburn, N. Y.—H. L. Storke, President.

ERIE TELEPHONE AND TELEGRAPH CO., Boston, Mass.—James W. Bennett, President; Charles J. Glidden, Treasurer.

GREAT SOUTHERN TELEPHONE AND TELEGRAPH CO., Nashville, Tenn.—J. J. Fowler, Assistant General Manager at New Orleans.

HUDSON RIVER TELEPHONE CO., New York City.—H. L. Storke, Treasurer; A. B. Uline, General Manager; W. H. Cull, Superintendent.

METROPOLITAN TELEPHONE AND TELEGRAPH CO., New York City.—W. H. Eckert, General Superintendent; J. A. Seeley, Electrician.

NEW YORK AND NEW JERSEY TELEPHONE CO., Brooklyn, N. Y.—Charles F. Cutler, President; W. D. Sargent, General Manager; J. C. Reilly and C. H. Barney, Division Superintendents.

NEW YORK AND PENNSYLVANIA TELEPHONE CO., New York City.—Joel C. Clark, Treasurer; W. N. Eastabrook, General Manager.

NEW ENGLAND TELEPHONE AND TELEGRAPH CO., Boston, Mass.—J. N. Keller, General Manager; J. J. Carty, Superintendent.

OHIO VALLEY TELEPHONE CO., Louisville, Ky.—J. B. Speed, President; James Clark, Vice-President and Treasurer.

PROVIDENCE TELEPHONE CO., Providence, R. I.—Henry Howard, President; Henry C. Cranston, Vice-President; Charles T. Howard, Secretary; J. U. Starkweather, Director; J. W. Duxbury, General Manager; A. C. White, Superintendent.

PENNSYLVANIA TELEPHONE CO., Harrisburg, Penn.—William Ker, General Manager.

SOUTHERN BELL TELEPHONE AND TELEGRAPH CO., New York City.—D. I. Carson, General Superintendent; C. E. McCluer, John D. Easterlin and W. J. Cole, District Superintendents.

SOUTHERN MASSACHUSETTS TELEPHONE CO., New Bedford, Mass.—Samuel Ivers, Treasurer.

SOUTHERN NEW ENGLAND TELEPHONE CO., New Haven, Conn.—Morris F. Tyler, President; H. B. Frost, General Manager; Ellis B. Baker, Superintendent.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE CO., Boston, Mass.—John E. Hudson, General Manager; C. Jay French, Assistant General Manager; W. R. Driver, Treasurer; Thomas Sherwin, Auditor; Thomas D. Lockwood, E. T. Gilliland, Electricians; Thomas B. Doolittle, Charles R. Truex, Robert S. Boyd, J. M. Brown, Special Agents; Albert O. Morgan.

BELL TELEPHONE CO., OF CANADA, Montreal, Canada.—Charles F. Sise, Vice-President; Hugh C. Baker, Manager for Ontario.

BRIDGEPORT BRASS CO., of Bridgeport, Conn.—Fred A. Mason, Henry D. Stanley.

CALLENDER INSULATING AND WATER-PROOFING CO., of New York.—W. M. Callender.

CHILDS, WM. A., New York City.

CHEEVER, CHARLES A., New York City, by W. L. Candee.

CLARK INSULATED ELECTRIC WIRE CO., Philadelphia.—J. Chester Wilson, General Manager.

DAY, A. G., New York City, by Clark B. Hotchkiss.

LOCKWOOD, THOMAS D., Boston, Mass.

PHILLIPS, EUGENE F., Providence, R. I.

ROEBLING'S SONS, J. A., New York City, by H. L. Shippy.

SAWYER, W. H., Providence, R. I.

STANDARD ELECTRICAL WORKS, Cincinnati, O.—E. V. Cherry, Vice-President; Isaac Kinsey, E. A. Kinsey.

WESTERN ELECTRIC CO., Chicago, Ill.—E. M. Barton, W. R. Patterson.

WILEY, GEORGE L., New York City, representing the Standard Underground Cable Co., of Pittsburgh, Pa.

THE PRESIDENT—There is now an opportunity for the presentation of new names for members of the Association, both active and honorary.

The American Telegraph and Telephone Company, of New York, was nominated for active membership, and the nomination being seconded, a vote was taken and the Company was admitted.

The Secretary proposed the name of the Callender Insulating and Water-proofing Company, of New York, for honorary membership, and the nomination being seconded, a vote was taken and the Company was admitted.

MR. HALL—I would present for honorary membership the name of Theodore N. Vail, of Boston, and I would move that the Treasurer be directed to draw a check for the amount of his initiation fee.

The motion was seconded, and upon being put to vote, was unanimously adopted, and Mr. Vail admitted to honorary membership.

THE PRESIDENT—The next business in order is the election of officers for the ensuing year. In this connection you will perhaps permit the Chair to announce the fact that he is not a candidate for renomination, and to say a word or two regarding the business in which we have been engaged and the history of the Association. But before doing that I find that I have made one omission. You will listen first to the report of the Secretary for the last year, and to the minutes of the meeting of the Executive Committee, embodying certain important recommendations.

The Secretary then read his report, as follows:

SECRETARY'S REPORT.

To the National Telephone Exchange Association:

GENTLEMEN—The object of this Association, as stated in Article II. of the Constitution, is "for the purpose of collecting, preserving and protecting all matters of importance to telephone interests."

At the time this Constitution was formulated the membership was large, and many members paid for the privilege of having several votes. Several still continue this practice of paying dues for two or three votes, but the balance reduce their annual dues to $10, which is the minimum amount, and entitles them to but one vote. Since then the absorption, amalgamation and consolidation has been steadily going on, so that our membership is now reduced to 41 active and 30 honorary members. Of the active members, six on the list, as published last year, have been absorbed, and, following the custom of previous occasions, their dues should be remitted and their names be stricken from the list. The names are as follows:

American District Telegraph Co., Erie, Penn. (Dues for 1883, 1884, 1885—$30.)

Beach & Hunt, West Winstead, Conn. (Dues for 1883, 1884 and 1885—$30.)

Danbury Telephone Despatch Co., Danbury, Conn. (Dues for 1883, 1884 and 1885—$30.)

C. W. McDaniels, Carthage, Mo. (1884 and 1885—$20.)

Loomis & McDaniel, Joplin, Mo. (1884 and 1885—$20.)

The Commercial Telephone Co., Albany, N. Y. (1885—$10.)

This reduces the actual membership to 36.

Of these 36 members, the Bell Telephone Company, of Philadelphia, now pays $20 per annum for two votes; The City and Suburban Telephone Association pays $30 for three votes; The Metropolitan Telephone and Telegraph Co., of New York city, pays $30 for three votes; The Michigan Telephone Co., Detroit, Mich., pays $30 for three votes. The balance pay the regular rate of $10.

If these members generously continue to pay at the above rates, the total revenue of the Association will be $430. If they conclude to pay as the rest do, $10 per annum for one vote, then our revenue is $360 per annum.

The diminished membership, and consequent loss of revenue, makes it necessary that some arrangement should be made that will bring more money into the hands of the Treasurer. The expenses of the Association during the present year, including the services of a stenographer for the Philadelphia meeting and the printing of the proceedings of that meeting, amount to $867.35. A number of the Proceedings of the Association are still on hand, but the sales have not met the expense of printing them.

At the Philadelphia meeting, a resolution was adopted which abolished the Standing Committees and placed their work in the hands of the Secretary, who, by and with the advice of the President, was to select certain members of the Association to assist him in gathering the information heretofore done by the various Committees. In pursuance of this resolution, the most important subjects were assigned to the various members, and others were asked to contribute papers. The success of this arrangement can best be judged by the results of this meeting.

The future of the Association deserves most serious consideration, and the writer, after several years' experience on two different Committees, and this year as Secretary, is more and more impressed with the idea that we should employ a Secretary at a salary sufficient to enable him to devote his time entirely, or nearly so, to the business of the Association, and who would be able at each of our meetings to present a concise history of the business during the year, illustrated and amplified by statistics that would be very much more reliable than any figures which we have been able to get by the voluntary system heretofore.

As Secretary of the Association, it should have been my duty, as it would have been my pleasure, to have presented such a history on this occasion, but I could not at any time during the year spare the time necessary to do the subject justice.

We have been passing through a period of business depression that has been discouraging to many of our members, but it seems to me that these very trials ought to encourage them and strengthen the bonds of union which unite the Association, as the Constitution says, "for the purpose of collecting, preserving and protecting all matters of importance to telephone interests."

An important and agreeable event of the year was the gathering of our members at Boston, as the guests of the American Bell Telephone Co., in July last. Such meetings, pleasant in themselves, are also calculated to promote the business interests of all concerned. Some of our distant members who were present at that meeting have not felt that they could spare the time and

expense of attending the present Association meeting. I think this feeling is wrong, as we can certainly well afford to come together twice a year, considering the many varied and difficult problems that are constantly arising in the growth and development of our business.

The Treasurer's report is herewith submitted, and it will be seen that our finances are very low.

W. D. SARGENT, *Secretary.*

H. L. STORKE, *Treasurer*,

In account with NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

1884.					
Oct. 8	To cash				$738 54
Sept. 16	" So. Mass. Tel. Co., Dues, 1884	$10 00			
"	" Providence Tel. Co., Dues, 1885	10 00			
"	" Central Dist. Printing Co., Dues, 1884	10 00			
			30 00		
Oct. 10	" John Cassidy, copies of Proceedings		2 00		
" 29	" Palmer Wire Co., Dues, 1884-5		25 00		
1885.					
Feb. 17	" Am. Bell. Tel. Co., copies of Report.	11 25			
"	" Pennsylvania Tel. Co., copies Sixth Annual Meeting	1 50			
"	" Bell Tel. Co. of Missouri, copies of Report	7 50			
"	" Pennsylvania Tel. Co., Sixth Annual Meeting	2 25			
"	" Geo. C. Maynard	4 03			
"	" N. Y. and N. J. Tel. Co., copies of Association Meeting	7 50			
"	" Chas. C. Howard, copies of Record of Meeting	1 29			
"	" C. N. Fay	2 00			
"	" So. Bell Tel. Co	50			

1884.					
Oct. 13	By C. N. Fay	Voucher No. 46		$300 00	
"	" Samuel M. Plush	" " 47		27 50	
"	" R. A. West	" " 48		135 45	
					$462 95
" 17	" Brooklyn Eagle	" " 49			28 75
1885.					
Jan. 5	" W. D. Sargent	" " 50			10 00
Feb. 26	" Brooklyn Eagle	" " 51		308 25	
"	" "	" " 52		8 25	
					316 50
Sept. 7	" "	" " 53		14 50	
"	" W. D. Sargent	" " 54		15 00	
"	" B. E. Sunny	" " 55		19 65	
					49 15
	Balance				37 45

"	19—	" Western Electric Co.....	16 25		
"	24—	" Lan. and C. Tel. Ass'n, Limited....	3 99		
				58 60	
Mar.	9—	" C. J. French, copies of Meetings....	3 70		
"	10—	" Western Electric Co.....	10 80		
"	24—	" Wisconsin Tel. Co., copy of Meeting	1 25		
"	30—	" Chas. P. Sclater, copy of Meeting...	4 20		
				19 95	
Aug.	25—	" Western Electric Co.		1 25	
Sept.	4—	" Hudson River Tel. Co., Dues, 1885	10 00		
"		" So. Bell Telephone Co., " .	10 00		
"		" East Tennessee T. & T. Co., " .	10 00		
				30 00	
				$904 80	$904 80

The reports of the Secretary and of the Treasurer were accepted and ordered placed on file.

The Secretary then read the minutes of the meeting of the Executive Committee held just previous to the meeting of the Association. They are as follows:

MINUTES OF MEETING OF EXECUTIVE COMMITTEE.

The Committee met at the Narragansett Hotel, Providence, R. I , September 8, 1885, at 10 A. M., a quorum being present.

The Report of the Treasurer for the past year was received, examined, and found correct.

It was voted that the sum of $300 be paid the Secretary as salary for the year past.

The following were fixed as the hours of business for the present meeting of the Association, viz.: 10.30 A. M. to 1 P. M., and 3 to 5 P. M.

It was voted to present the following recommendations for the action of the Association, viz.:

First—That an assessment of $40 per member be levied and paid to the Treasurer of the Association, to provide for the expenses of the ensuing year, and that the Constitution be amended accordingly, making the annual dues $50 instead of $10.

Second—The advisability of employing a paid Secretary, at a salary not exceeding $100 per month, and that the Constitution be amended to provide for the appointment of the Secretary by the Executive Committee.

W. D. SARGENT, *Secretary.*

THE PRESIDENT—This will furnish business for the Association after the election of officers. It was the opinion of the Executive Committee that the Association had now reached a point where it was well worth their while to employ some capable person, for a good part of his time throughout the entire year, to collect, classify, keep and distribute all sorts of statistical and other information regarding our business, with permanent headquarters either in Boston or New York; that for this purpose a salary of not more than $100 per month should be paid, and to provide for this the only method was by assessment, by vote of the Association. In order that this method of assessment may not come up every year, they recommend that at the next session the Constitution be amended, making the annual dues for each member of the Association $50, and such amendments of the Constitution as will enable the ap-

pointment of a Secretary who will be the active officer of the Association, probably by the Executive Committe rather than by the ballot of the Association. The proper person can be selected in that way better than by the general ballot of all the members. These most important matters will come up for formal action later in the course of this session. I have now to read a note, just handed me, to this effect :

" The American Bell Telephone Company extend an invitation to the members of the Association to visit Leicester, Mass., on Saturday next, for the purpose of examining the ' village system,' now in operation at that place. A special car will be provided."

Further details, I suppose, will be furnished the Association by the representatives of the American Bell Telephone Company, between this and Saturday.

RETIRING ADDRESS OF PRESIDENT TYLER.

Before proceeding to the election of officers, allow me to say just a word, rather in the way of reminiscence than anything else, in relation to the business of the Association for the term of its life—really. for the last five years. Those of us who came together at Niagara in September, 1880, see, of course, to-day, in looking around over this audience, a good deal of change. We were not so many as we are now, when we met in the parlor of the hotel at Niagara, and when, notwithstanding the attractions of the place, the amusements outside, we managed to do a good deal of work in the course of a few days. The circumstances under which we meet have so materially changed, that it tempts one to look back over the history of our business and trace roughly the course that it has taken. I remember very well when we came together in 1880, all strangers to one another. For my part, I don't think there were three men in the company that I had ever seen before, except the American Bell Telephone Co.'s agents. We were all in a state of enthusiastic uncertainty. I don't believe that there was a single company there represented which could say, putting its hands upon the figures, " We are making a cent." And, what is more, I don't believe that there was a single company represented there that could say, definitely, with its hand upon its books, " We expect to make a cent," in a definite, distinct way. It was for that very reason—from the very fact of the indefiniteness of our enthusiasm—one of the most remarkable gatherings I ever attended. We were all full of hope, and yet, when we analyzed our hopes, they were very airy indeed. When we came together, however, in the spring of 1881, we were in altogether a different condition. Things had begun to crystallize. The difficulties from the opposition of the Western Union and Drawbaugh Companies had been all substantially swept out of the way, We had not reached that point where we felt like " swelling " out in fine clothes and high living on our profits. But the year 1881-1882, I think, saw the most self-contented men gathered to-

gether in the American Telephone Convention that had ever been brought together in one room. We had all of us made money. We all of us saw an indefinite expansion of the business before us, and we didn't know when the end could be. It was going to be a long way off. In 1883, when we met in Boston, we were not so enthusiastic. All of you remember that when we met in 1884, in Philadelphia, we were "blue." We have been through the period of eager expectancy in the beginning; we have been through the flush of first and almost unexpected success, and we have reached now the period of steady, unremitting work, of constant anxiety, of careful forecastings, not only of to-morrow, but of next year; and we have reached the position in our business of maturity, where we are threatened with all the dangers of an established business, and we are burdened with all the responsibilities of very large interests to care for.

Now in looking back over the five years, to my mind the most natural thing to do is to point out the mistakes that have been made. But it would be an ungracious task on my part now to tell you those things which you all know perfectly well and which in many instances you only too bitterly regret. It is of no use now to say that we made mistakes in calling what cost us a dollar four dollars. It is of no use now to say that we vainly imagined that the growth of the first six or eight months of a business that was new, after it attracted attention, was going to continue for six or eight years. We know it only too well. It is of no use to say that we were altogether too confident as to the amount of money which it was going to take either to build, maintain, or operate a plant. We derived no benefit to ourselves, and we certainly got no credit from the public. So we have been altogether too generous with the public, and have given them what we have sold them for too little money. And, what is worse, we get no benefit to ourselves and we get not one word of credit from our stockholders, when some of us feel that we have been too generous with our stockholders and have given them money which we ought to have kept for a "rainy day." But these mistakes have all been made by some of us, some one and some another, and some of the companies are suffering from their results.

Another thing: When we look back for the five years and review that most important part of our business, the relation of the licensee to the licensor, we find that there is a good deal to be said there which might be said perhaps to the advantage of both sides, and a good deal which might be said to the disadvantage of both sides. It is barely possible that the licensee, on some occasions, has too much confidence in his licensor, and that on some occasions the licensor has expected too much of the licensee. It is certain, however, and I think all will agree with me in this, and that it can be said by all of us, without any reflection whatever upon the goodness of intention of either party, that the plan upon which the business was started, and the general plan upon which it has been attempted to regulate the relations of licensor and licensee throughout the country, has its elements of weakness and mistake. While not attempting to "make flesh of one and fish of the other," the fact has been forgotten that some *are* "flesh" and some are "fish." While treating everybody alike, the fact has been overlooked that everybody is *not* just alike. While thinking that one section possibly of the business should produce to the parent company the

same ratio of profit as any other section of the business, it has been forgotten that one section of the business was of almost immeasurable value and almost limitless growth, while another section of the business has reached its limit of value and limit of growth very much sooner than was expected. But these are mistakes which it was very easy and very natural, not only for the licensor to fall into, but for the licensee also to fall into and acquiesce in. The mistakes have been made. A good many of you were not concerned in them. Some of us are most vitally concerned with them. And to some of us, questions of most grave importance connected with this matter of the relation of licensor and licensee are now staring us suddenly in the face. I don't propose to make any suggestions now. It would be entirely out of place here, regarding the settlement of those questions. I don't propose to give you any scheme where, in my weak judgment, these mistakes which have been made can be avoided. I only want to make one remark to such licensees as are in this condition—and I know they are represented here—and that is this: it is always a much more difficult thing to get out of a bad place than to get into it. And with any party having large and varied interests at stake and dealing with a large number of persons or corporations, action is necessarily slow. While we who are suffering vitally from errors of calculation which have been made may think that with a stroke of the pen, or with a word, our difficulties can be relieved, we must remember that we are only one side, and that there is another side. I think it only fair for me to say that licensees now in this condition should take into consideration the fact that we have at least one evidence of a desire and an intention on the part of our licensor to so change the relation of licensor and licensee, as, if possible, to make them, where they are inequitable, more equitable, and to hope from this that where this change which has already been made does not produce the desired effect, other things may still come. It is a problem at which both sides must work, and assistance will be needed from licensees as well as from the licensor in order to bring about such a readjustment of relations as will make the burden equal, as will relieve one without over-burdening another. In this spirit, then, I want to suggest to such licensees as are in this condition, a temper of willingness to meet conciliation, and also a temper of willingness to grant, to a certain extent, conciliation where it seems to be necessary. I think, gentlemen, so far as I can see, looking over the telephone field, as I am informed of it, we have reached the bottom of the curve and are beginning to rise. How far we shall go upon the upward slope before it drops again of course no one can tell. We are, of course, in many respects largely dependent on the condition of general business, not so dependent, perhaps, as ordinary commercial business, but still, in our initiative state, in our still unfinished and undeveloped state, we are very largely dependent upon the condition of general business. General business shows signs of improvement, which can lead an honest observer, I think, to conclude that a permanent recovery has set in, not speculative, but permanent. We shall sooner or later reap its benefits. Let us be careful in the conduct of our business hereafter, that we keep our eye upon the errors which we made in periods of past recovery, and not repeat them, and with a temper of one helping another, which I think should be indulged in by all of us regarding our licensor, we may yet,

within a reasonable time, find ourselves all upon that delightful basis on which some of the licensees, I am very glad to say, now stand, when we can pay a dividend upon all our stock after we have deducted both expenses and construction.

Gentlemen, I wish to present to the Association my acknowledgements for the honor which has been done me personally in my appointment to the place, which I have endeavored to fill for two years. I call upon you now, gentlemen, for nominations for the office of President of the Association for the ensuing year.

MR. EASTABROOK—Without any eulogy, I desire to present the name of C. N. Fay, of Chicago, for the office of President of the Association for the ensuing year. His very effective work as Secretary in years past and the many statistical tables that he has presented will recommend him to all the members without further remark.

The President called for further nominations, but no others were presented.

MR. EASTABROOK—There being no further nominations, I move that the Secretary be requested to cast one ballot for Mr. Fay as President of the Association for the ensuing year.

The motion was adopted, the Secretary cast his ballot accordingly, and the Chair announced the election of Mr. Fay.

MR. METZGER—I nominate for Vice-President George F. Durant, of St. Louis, Mo.

MR. DURANT—I decline, for this reason: Mr. Fay is from the West, and, if I am elected, there will then be two from one section.

THE PRESIDENT—Even though the objection of Mr. Durant be well taken, I am quite sure this Association will waive all objections upon this score. Mr. Durant is nominated for the office of Vice-President, and the nomination is seconded.

MR. METZGER—There being no further nominations, I move that the Secretary cast his ballot for Mr. Durant for Vice-President.

The motion was adopted, the Secretary cast his ballot accordingly, and the President announced that Mr. Durant

was duly elected Vice-President for the ensuing year, and appointed Messrs. Metzger and Barney a committee to escort the Vice-President to the chair.

Vice-President Durant, in the absence of President Fay, then assumed the chair, and said: This is to me a very unexpected honor, for which I most heartily thank you. I am not very much skilled as presiding officer, but will endeavor to discharge the duties to the best of my ability. The next business in order is the nomination and the election of a Secretary.

MR. B. A. CARSON—I desire to nominate General C. H. Barney, of the New York & New Jersey Telephone Company.

The Chair called for further nominations, but none were presented.

MR. CARSON—There being no other nominations, I move that the Secretary be instructed to cast his ballot for General Barney for Secretary.

The motion was adopted, the Secretary cast his ballot accordingly, and the Chairman declared General Barney elected.

THE CHAIRMAN—The next business in order is the nomination and election of a Treasurer.

MR. CUTLER—I re-nominate the gentleman who has held the position with so much ability during the past year, Mr. H. L. Storke.

The Chair called for further nominations, but none were presented.

MR. CUTLER—I move a suspension of the rules, and that Mr. Storke be elected by acclamation.

The motion was adopted, and Mr. Storke was elected Treasurer by acclamation.

MR. STORKE—I accept upon one condition, and that is that you all stand a heavy assessment next year.

The Chair appointed Mr. B. E. Sunny, Mr. D. I. Carson and Mr. W. N. Eastabrook a committee to escort the newly elected Secretary and Treasurer to the Chair.

GEN. BARNEY—I thank the Association for the honor

conferred. I enter upon the duties of office with a great deal of diffidence, in view of the distinguished gentlemen who have preceded me as secretaries of this Society. If I succeed in discharging the duties of the office as well as they have done, my ambition will be fully gratified.

THE CHAIRMAN—The next business in order is the election of two members of the Advisory Committee, one in place of Mr. H. B. Lytle, for one year, who has become ineligible, and one in place of Mr. G. C. Maynard, whose term of office has expired.

MR. SARGENT—I nominate Morris F. Tyler, of the Southern New England Telephone Company, to fill the vacancy occasioned by the expiration of the office of Mr. Maynard.

A vote was taken, and Mr. Tyler was declared elected a member of the Advisory Committee for the next three years.

Mr. B. E. Sunny, of Chicago, was nominated for member of the Advisory Committee, to serve instead of Mr. Lytle.

A vote was taken, and Mr. Sunny was declared elected for the unexpired year of Mr. Lytle's term.

THE CHAIRMAN—The next business in order is the election of an Executive Committee, of four members, in place of Messrs. James Bigler, H. N. Gifford, Henry Metzger and W. N. Eastabrook.

Messrs. James Bigler, R. M. Bailey, C. F. Cutler and Henry Metzger were nominated for members of the Executive Committee.

A vote was taken, and the gentlemen named were declared elected.

THE CHAIRMAN—The next business in order will be the fixing of the place of the next annual meeting. It requires a two-thirds vote of the members of the Convention.

MR. SARGENT—I move that this Association meet next year in St. Louis. I might say that the Association is practically bound to go to St. Louis, because we had an invitation from the St. Louis Company two years ago, but on

account of the Electrical Exhibition in Philadelphia, our meeting was changed from Providence to Philadelphia last year, and we are holding the Providence meeting now. So we owe a debt of honor as regards St. Louis, and I therefore propose that the next meeting be held there.

MR. CUTLER—Is this a new invitation, or does the old invitation hold over?

THE CHAIRMAN—As I understand it, the St. Louis Company still consider that their invitation holds, and they are very anxious to have the Association meet there. It appears in the report that we agreed to meet in Providence in 1884, upon condition that in 1885 we should meet at St. Louis. I think you will find this recorded in the minutes.

The motion to meet at St. Louis was seconded.

THE CHAIRMAN—All those in favor of meeting next year in St. Louis, at the time fixed by the Constitution, will say "Aye."

MR. METZGER—Mr. Eastabrook says that the Constitution has been so amended that each Convention is to fix the time of its annual meeting.

MR. SARGENT—The gentleman is correct about that. We shall have to fix the date in order to make our action complete.

THE CHAIRMAN—I would like to explain that about the second week in September our Exposition opens, and is followed shortly after by the Annual Fair, when there is a great influx of people at St. Louis, and it is impossible to get hotel accommodations. But if you can fix the date as the first week in September, no difficulty will be encountered.

MR. CHERRY—I think the first Tuesday in September would be in rather warm weather. Would it not be better to defer it until after the Fair meetings?

THE CHAIRMAN—That would throw it into the latter part of October or into November.

MR. CARSON—I move, as an amendment to the motion of Mr. Sargent, that this matter be referred to a committee of three, to report to-morrow morning.

The motion was adopted, and the Chair appointed as such committee Messrs. Carson, Eastabrook and Metzger.

THE CHAIRMAN—The next business in order is the reports of Committees. We are ready to hear a report from the Committee on "Wire Gauge."

MR. W. D. SARGENT, of Brooklyn, N. Y., then read the report of the Committee on "Wire Gauge," as follows:

MR. PRESIDENT AND GENTLEMEN—Your Committee on Wire Gauges received replies from the following parties:

1. Clark Insulated Wire Co., Bristol, Penn., favor the English standard gauge, and state that the present uncertainty in gauges is an embarrassment to their business.

2. W. A. Jackson, of Detroit, Mich., is in favor of a standard gauge, but has no preference.

3. C. N. Fay, of Chicago, favors the English gauge, because we buy more or less wire in England.

4. Alfred F. Moore, of Philadelphia, favors the American gauge, because all manufacturers of insulated wire use it.

5. E. T. Gilliland, of Boston, favors the micrometer screw and diameters in mils or thousandths of an inch.

6. The Palmer Wire Co. are very much in favor of a standard gauge, but express no preference.

7. The Phosphor-Bronze Co., of Philadelphia, favor the English standard gauge, except in the finer sizes, and thinks if no standard is adopted, that all gauges should be abandoned and the micrometer screw used to indicate sizes of the decimal part of an inch.

8. The Standard Electrical Works, of Cincinnati, desire to see a standard wire gauge established, because they are constantly annoyed by orders for wire, but without specifying the individual gauge. Their preference is the American gauge.

9. Holmes, Booth & Hayden, of New York, are sensible of the importance of a standard gauge, and recommend the adoption of the English gauge, so that there will be a uniformity between the two countries.

10. The American Electrical Works, Providence, R. I., say that they are greatly annoyed in their business by the multiplicity of gauges. They favor the entire abolition of all gauges, and wires to be identified by their diameter in thousandths of an inch. In practice they find this plan works well in their particular business, and they claim to have abandoned the use of special gauges in the work of their factory, and their employees know the wire by its diameter in thousandths of an inch better than they know the gauge.

11. The Western Electric Manufacturing Co., of Chicago, believe that the American gauge and the English standard gauge are the only two to be considered. They prefer the English standard, because we can never hope that the English will adopt ours, and it is a matter of considerable importance to have a uniform standard gauge wherever the English language is used.

12. Clark B. Hotchkiss, of the Kerite Wire, suggests the English gauge and the American gauge, but with a preference for the English, because it is in use both in France and England.

13. D. H. Bates, President of the Baltimore & Ohio Tel. Co., thinks the Birmingham gauge is the nearest to perfection of existing gauges, but is much interested in any movement looking towards the establishment of a uniform gauge. He thinks the numbers given with a given diameter should bear some definite relation to the measurement in mils, and wishes to know the result of our deliberations.

14. The Callender Insulating Co. believe that it is of the utmost importance that some uniform gauge should be adopted, and that it would be an immense advantage if it could be made international. They recommend the English gauge in preference to all others.

15. Washburn & Moen believe that the decimal or metric system of gauges would be the best to adopt. They were the first concern to use the "V" gauge in the world, and state they have found it convenient and reliable, and by its use have avoided much annoyance. They express no preference for any particular gauge, but believe that any that would be standardized would soon be generally adopted by manufacturers.

The Western Electric Company supplement their first reply by the following memorandum from their agent in Antwerp:

"You may not be aware that there is no ascertainable gauge in use by the English. The brass people, for example, do not know the gauge called "B. W. G." in your telegraph catalogue; and the only way to get what you want is to give the sizes in mils. So far, I have heard of no move among the English to adopt a new standard gauge, and, until they adopt that, I do not see that you are going to gain anything by abandoning the American gauge which people now understand. The English gauge has been legalized by the Board of Trade, but this amounts to no more, in practice, than the legalization of the metric system in America. The metal people are all against the new gauge, and say it was made up by a set of people who knew nothing about the thing practically. Perhaps they say this because they were not consulted in the matter."

Mr. Barton, of the Western Electric Company, commenting on this memorandum, says: "The great difficulty about gauges, at present, is that there are no safe gauges in common use. The convenience of the public is not so much to get any new gauge adopted as to get all the gauges in use, except one, discontinued. The United Association might now secure the almost universal adoption of the American gauge, while in my judgment the adoption of the English gauge would result only in adding one more to the number of gauges now in use. I have learned, by discussing the matter with general drawers in the United States, that they would much prefer to adhere to the American gauge."

Your Committee have placed themselves in communication with all the parties in interest. While we have no written or official reply from the Western Union Telegraph Company, we are inclined to believe if this Association would favor the adoption of the English gauge, they would co-operate with us.

The replies come from fifteen different parties. Seven favor the English, and two the American gauge; six have no preference.

The work of investigating the origin and development of the numerous gauges in various countries, analyzing and comparing their merits, and discarding all the disadvantages without making too great a departure from the Birmingham wire gauge, which is the most generally used, is so thoroughly done by a committee of the British Society of Electrical Engineers, that the committee feel that they will honor themselves and gratify their English friends by accepting their conclusions, and recommending the English standard gauge as the one best adapted to the wants of this country, and in lieu of any arguments of their own in favor of this decision, we refer the members of the Association to the report of the English Society, published in Volume VIII. of their proceedings.

Mr. W. H. Preece, a member of this committee, has very kindly furnished your Committee with the instructions and orders of the British Board of Trade legalizing and making this the standard gauge of Great Britain. He also furnished a number of copies of the gauge, which we submit to the inspection of members.

The Committee desire to express their thanks to Mr. Preece for his courtesy in furnishing them with all the information on the subject, as far as the British Government was concerned.

W. D. SARGENT,
D. I. CARSON.

MR. SARGENT—In regard to the merit of the American gauge, as compared with the English gauge, I don't think there is any difference whatever, and I do think it is desirable that the gauge should be uniform in the two countries. That is the only object I have in recommending the English standard gauge. I think probably the best plan is for the Association to adopt, by vote, whichever gauge they fix upon. Either will be well enough, if it is standardized. The report is offered more for discussion than for a final conclusion.

THE CHAIRMAN—This is an important matter. The report is now before you. What is your pleasure in regard to it?

MR. CHERRY—For the purpose of bringing this matter before this Committee for discussion, I move that we adopt the English gauge as the standard.

MR. KER—Will the gentleman inform us what else it is called?

MR. HOTCHKISS—I am informed of late that not only has the English Government adopted the ordinary rule, which we all know of, to bring wire to a standard diameter, based

upon the impartial measurement which had been adopted by the French Government, but it has been since that time approved of and adopted by the German Government, so that the Germans, the French and the English are now using one standard wire gauge.

THE CHAIRMAN—If the Association is to take action upon this matter now in adopting any gauge, I suggest that it should be submitted in writing, giving the numbers in one column, and the measurements in thousandths in another column, so that there would not be any confusion about it, for there are so many English gauges—the Birmingham, the English old standard and the English new standard—that we are liable to be somewhat confused. I presume these gauges are to be had here.

MR. CALLENDER—I would suggest, before any action is taken, that we confer with the Electric Light Association, with a view to adopting one and the same gauge.

MR. SARGENT—I don't believe that it is necessary for us to confer with the Electric Light people. I think we can take this action ourselves. If we do not do it, the thing is deferred and nothing is done. I tried to confer with the Western Union people, but I could not get anything official from them. The only thing they could say was that they favor the English standard gauge. Now, perhaps all the members do not understand that the English standard gauge is simply the old Birmingham gauge standardized, that is all. The irregularities are taken away from it, and it is scientifically just as perfect a gauge as the American gauge.

MR. LOCKWOOD—Mr. Sargent honored me, among others, by asking what I thought in the matter of the gauge question, and the only reason I did not reply at length to him was that I had not had and never do have time to do so. But I am very strongly in favor, nevertheless, of the new standardized English gauge, simply for the reasons that he has already given. It is certainly equal in its merits to any gauge that is before us. As he says, the English will certainly never give way to us. That I ought to know. And it is a stand-

ard. Any standard is preferable to the lamentable lack of standard which we now suffer from. Yet I am sadly afraid that even after that or any other gauge is standardized, persons requiring wire in large quantities, whether it be line wire or office wire, will be sure of getting what they want by ordering wire of a certain size in mils. And it may be wise to state that the term "mils" is not an abbreviation of millimeter, but simply means thousandths. They will order wire in so many mils. Perhaps in the case of line wire they will order it of such a weight, not to be less than a minimum weight per mile. And I think also, as we come more to a solidified and condensed condition of working, we shall order wire of a certain specific resistance, per pound, per mile. I should specify the kind of wire and the weight of wire. I don't think any change of gauge will materially affect that. Nevertheless I do endorse the English gauge.

MR. J. C. CHESTER WILSON—I would remark that a great many efforts have been made to establish a uniform gauge. The Civil Engineers' Society, and other societies, have tried to influence Congressional action in favor of a standard gauge, with a view to apply it in all legal questions, and to have contracts enforced under its measurements and sizes. If we confer with a committee, or have a committee confer with other organizations, the same delay will ensue as has ensued heretofore from similar attempts by other Associations. And I could admire the action of this Association very much if they would start out to be independent and adopt the new standardized English gauge. For the reasons which have been very fully and clearly stated, it seems very desirable; but by all means let us act decisively in the matter.

MR. SHIPPY—I think the gentleman is right about that. The English people have standardized this gauge. It recommends itself to everybody who will think upon the subject. If we adopt it we have benefited ourselves and the English people both. When the electric light people consider the question they will adopt what we do. And if we appoint a committee to confer with them, we may as well have a standard gauge and be done with it.

MR. CARSON--Inasmuch as Mr. Sargent has intimated that there was a difference of opinion in the Committee, it may be well, in order to complete the report, to say that I concur entirely with Mr. Sargent in the sentiments that he incorporates into the report and into his remarks.

THE CHAIRMAN--The Chair's recollection is that when this subject was first brought up it was with a view of securing, on the part of the Association, the adoption of some standard gauge, and recommending to Congress a legislation on that subject, similar to that which has been had in England. Our adoption of it would be of little or no effect, it seems to me, unless the members of the Association would bind themselves to use only wire drawn by that gauge. Are there any further remarks to be made upon the report? The motion is that a committee of three be appointed to confer with the Electric Light people in regard to the matter of adopting a standard wire gauge.

MR. CARSON—I rise to a point of order. My impression is that there is no such motion. Mr. Cherry made a motion that we adopt the English gauge, and Mr. Callender suggested that before such adoption we confer with the Electric Light Association.

MR. SARGENT—I will make a motion "That this Association, so far as they can, will adopt the English standard gauge for their future work." If it is necessary to put that in a more elaborate form, time can be taken to do it later on.

MR. CALLENDER—I move, as an amendment to Mr. Sargent's motion, that a committee be appointed by the Chair to confer with the Electric Light Association, with the view of adopting a general standard for all electrical companies.

MR. LOCKWOOD—I don't know whether it is in order to comment upon the amendment to Mr. Sargent's motion, but I think I will comment upon it whether it is in order or not. I most decidedly oppose any such action on the part of this Association. The Electric Light people, in their conventions and meetings, have shown a sentiment of utter disregard for our interests or for our welfare. They seem determined to

act "upon their own hook" in every sense. We should be conferring upon them an utterly unmerited compliment if we should consider that in this matter, or upon any other matter, we should act out of regard to what they may put forth. I do think that this Association should support Mr. Sargent's motion, which is the matter properly before us.

THE CHAIRMAN—The time for recess having arrived, I suggest that the matter be deferred to the afternoon session, when all views can be formulated and the question properly disposed of.

MR. CARSON—I move that the Convention take a recess until 3 o'clock P. M., and that the further consideration of the report be deferred to that time.

The motion was adopted, and the Convention took a recess until 3 o'clock P. M.

AFTERNOON SESSION.

The Convention re-assembled at 3 o'clock P. M., the President, Mr. C. N. Fay, of Chicago, in the chair, he having arrived since the morning session.

THE PRESIDENT—The matter under discussion is a resolution of Mr. Sargent, as amended by Mr. Callender. Does Mr. Sargent accept the amendment?

MR. SARGENT—I did not accept the amendment.

THE PRESIDENT—Is there any second to the amendment?

The Secretary read the amendment proposed by Mr. Callender as follows:

"That a Committee be appointed by the Chair to confer with the Electric Light Association with the view of adopting a general standard for electrical purposes."

THE PRESIDENT—As I hear no second to the amendment, I will put the question on Mr. Sargent's resolution as originally offered.

MR. SARGENT—In regard to the resolution that I offered as to the wire gauge business, I understand that Mr. Doolittle has a minority report that he would like to read be-

fore any further action is taken by the Association, and I would like, if it is within the rules, that this matter of wire gauge be postponed until he can get his papers and be heard.

THE PRESIDENT—Are you ready, Mr. Doolittle, to present your minority report?

MR. DOOLITTLE—Not fully. I am not in entire harmony with the report of the Committee, however, and I might possibly state the objections that I have to that report without a prepared document. I had written a little paper on the matter which was to have been forwarded, but has not yet arrived.

THE PRESIDENT—If there is no objection, we will receive any statement you may make in the place of any minority report in regular form.

MR. DOOLITTLE—The objection I have to this report of the Committee and the adoption of the English gauge is, that it seems to me that it would only add confusion to the present system of gauges. We now have too many kinds of gauges. The gauge longest in use among English speaking people appears to be one called the Birmingham (Stubs) or English iron wire gauge. There is also a Birmingham gauge for sheet metals other than iron and steel, for gold, silver, brass, etc. Then there is still another gauge for zinc. As a noted English writer, Holtzapffel, on mechanical subjects said, some forty years ago, of gauges then in use: "The Birmingham and other gauges seem to have originated in a great measure accidentally, or almost by the eye alone, and without any attempt at system as regards the values of the intervals between the successive measures or numbers. Moreover gauges nominally the same have been made by various manufacturers with insufficient aim at unity of measures, some irregularity thence exists amongst the gauges in common use notwithstanding that they may be nominally alike." This imperfection has been found so great in some gauges that a size that should be smaller than another was actually larger. We find some gauges made in the United States with but little improvement over the old

English gauges. We also have found a tendency to adhere to the old English absurdities, so that if we call for say No. 10 Stubs' steel wire, we would not get the same diameter of wire that we would by calling for No. 10 Stubs' iron wire. Among gauges made in the United States we find one made by the Washburn & Moen Manufacturing Co., of Worcester, Massachusetts, that fairly represents the irregularities between the intervals of successive measures or numbers of all but one gauge made in the United States. In this Washburn & Moen gauge we find the difference between six zero and five zero is thirty one-thousandths of an inch, while the difference between five zero and four zero, which should be less, is really thirty-seven one-thousandths of an inch. In a gauge having such irregularities we can form no idea of what the size of any number will be when we know the size of the next number.

After a careful examination of the different systems of gauges, we find that the American gauge, made by Darling, Brown & Sharpe, of Providence, R. I., is superior to all others. In this gauge we find that the intervals or steps between the measures or numbers are in regular proportion. The advantage of this is readily seen. In the American gauge, when we know the size of any number, we can pass at once to the size of the next number, either smaller or larger.

Multiply any size in the American gauge by $1\frac{1}{9}$, and we have the size of the next larger number nearly. Multiply the size of any number by $\frac{9}{10}$, and we have the size of the next smaller number very nearly. The exact ratios are given upon the drawing herewith presented. This feature is a great convenience. Even though we do not remember the ratios we can remember that the steps are regular, and that we shall not find more difference between the diameters of two small numbers than we will between the diameters of two larger numbers. Two sizes at the extremes of the English gauge were taken as a basis of the American gauge, and then such a ratio was calculated as would make the intermediate steps in regular proportion. This proportion

is the geometrical proportion, regular gradation. Perhaps I can explain that better by showing you a little diagram that I have made of the different gauges. I will get it from my room, and return in a few minutes.

THE PRESIDENT—Has any other gentleman anything to say about wire gauges? Perhaps Mr. Hotchkiss, who is actually engaged in using wire, may have a preference as to a certain gauge.

MR. HOTCHKISS—I thank you for your kindness in calling my attention to the matter. I spoke this morning upon the matter of gauges, and suggested that a new English standard gauge be adopted by this Convention, as it has already been adopted and is now in use by the German, French and English governments.

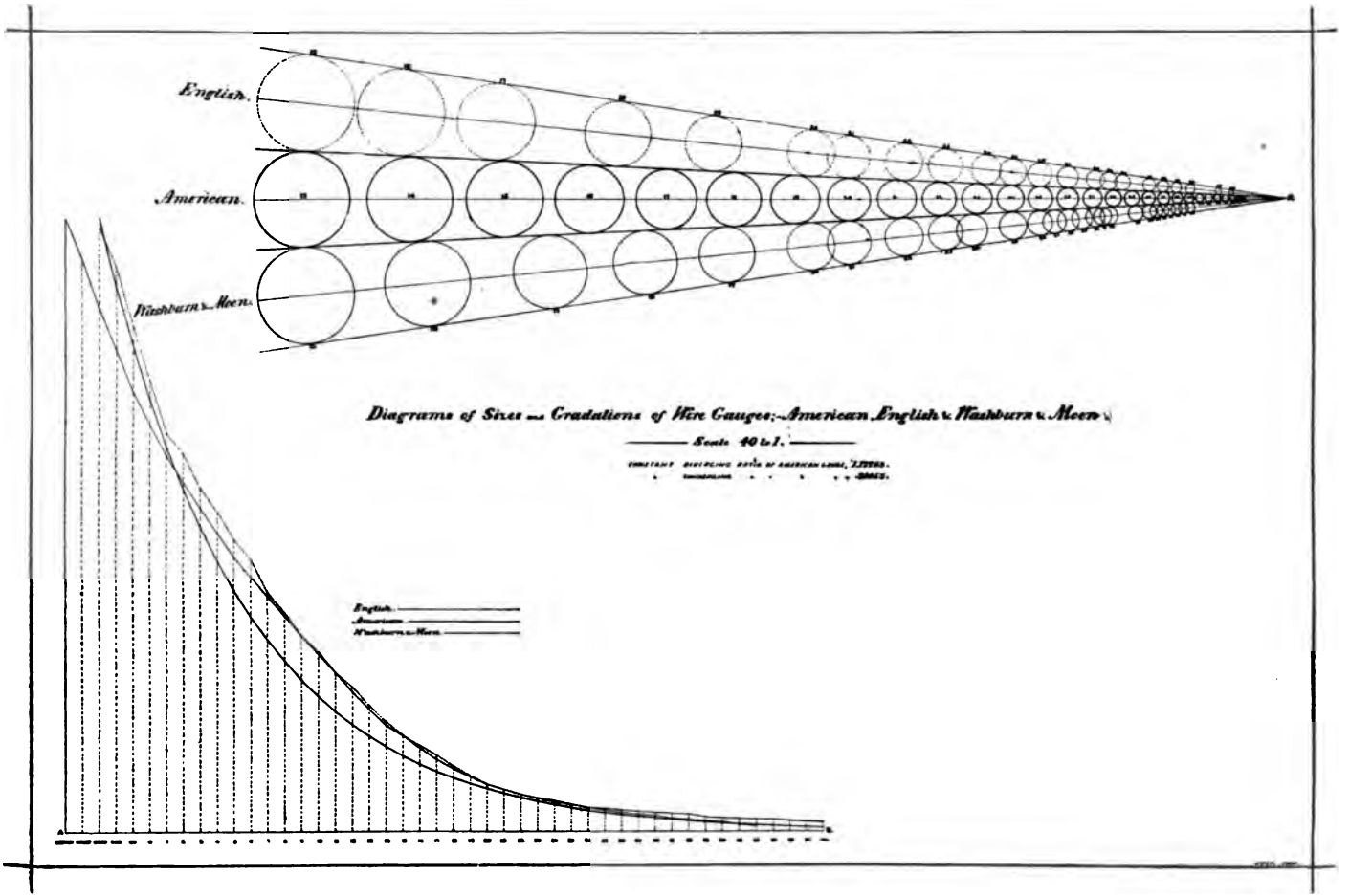
MR. DOOLITTLE (returning and explaining his diagram)—By referring to the drawing (see Plate) we can see a comparison between the American gauge and the two representative gauges, the Birmingham and the Washburn & Moen

In the upper diagram the sizes of the three gauges enlarged 40 to 1 are shown between three lines meeting at V. The English gauge is shown in the upper angular opening, the American gauge in the middle opening, and the Washburn & Moen in the lower angular opening. Each circle is placed at such a distance from the vertex or common point V as will make the opening between the lines just so the circle will enter. It will be seen that the English and the Washburn & Moen gauges are at irregular distances from the point V, because the size of these two gauges vary irregularly.

The circles representing the American gauge step off from the point V in regular proportion, which at once satisfies the eye, and I believe the American gauge itself will prove still more satisfactory to those who may use it in future.

The same comparison is shown between more numbers in the lower diagram by taking the sizes enlarged 40 to 1 as before, and laying them off upon the perpendicular dotted lines.

The starting point for measuring is the line A B. By


English.
American.
Washburn & Moen.
Diagrams of Sizes and Gradations of Wire Gauges;—American English & Washburn & Moen.
Scale 40 to 1.
English.
American.
Washburn & Moen.

connecting these points thus obtained upon the perpendicular dotted lines we get for the American gauge the regular line as shown, but for the English and Washburn & Moen gauges we get the broken lines, showing to the eye the great irregularity in the steps of the other wire gauge. These two wire gauges selected for comparison fairly represent the irregularities of all wire gauges that have come to my notice.

The different lines can be readily seen from the explanation upon the drawing.

English engineers, recognizing the necessity of reform in this direction, have, after much deliberation, recommended the adoption of a wire gauge called the New British gauge, which is practically a copy of the American gauge, and possesses little superiority over it. The credit is entirely due to the American inventors for the systematic arrangement of the wire gauge, as also for the invention of the micrometer gauge, by means of which the degree of accuracy of the fixed gauge may be determined.

In all large dealings there is no doubt that the size of wire will be determined upon by fractions of one inch, represented in one-thousandths, and measurements made by the use of the micrometer gauge, but for common use a fixed gauge is a necessity; therefore, in consideration of the fact that the American gauge is and has been in general use throughout the United States by the manufacturers of copper wire and sheet metals, also that it is based upon a correct principle, I would respectfully recommend its adoption for general use by the electrical fraternity for the measurement of iron, copper, brass or other wire, sheet metal, or other materials where wire gauge measurements are habitually employed. I would like to add that whenever anybody orders sheet brass, it is ordered by the American gauge in ninety-nine cases out of one hundred. That is generally accepted and understood. Also in the manufacture of copper and brass wire that gauge is understood. It is only with a few who are not familiar with it, the iron manufacturers who use an English gauge and the Washburn & Moen gauge that

the confusion comes in. I had a talk with Mr. Washburn, and he said it was immaterial what gauge the Association adopted. His company would be willing to fill orders by any gauge that would be accepted. If we should take the American gauge, which is now well known, and extend it into the field of iron wire, that would be all that would be necessary; everybody would understand it and there would be no confusion. If they had started out years ago on the same plan or principle that they now have adopted in Europe of the new British standard gauge, it would have been very desirable; but, such not being the case, we must accept the facts as they are. The English gauge, I think myself, is rather preferable to the American; there is no question about that. I should prefer the new English gauge. But it is my opinion that it would require a whole generation of time before we could succeed in introducing generally the new British standard gauge, and it is very doubtful if we ever could succeed. I am told that it is not in general use in England. It is only theoretically used there. They still adhere to their old English gauges; therefore I cannot agree with the majority of the Committee that it would be advisable for us to adopt the new English gauge. It would only take so much more time and add to the confusion of gauges, without helping the subject. There are manufacturers of wire here, I think, who will bear me out in this idea. I think the Western Electric Company will agree with me, and also all manufacturers of brass and copper wire. I would like to hear from some of the manufacturers who are present. I would like to hear the question fully discussed by those who know the most about it. Several years ago, when I was in the business of using wire, there was a very great confusion; we could not prove anything. There was no way to ascertain the correctness of the gauge after it had become worn. A customer might order wire, giving the number of his gauge, which having worn larger by much use, would mean a larger wire than he would receive, and, of course, he would be indignant, claiming that a wrong size had been sent him, and proving

this by his gauge, yet by my gauge we had sent him exactly the size ordered.

But after we had adopted the American gauge manufactured by Brown & Sharpe this trouble was removed, and the micrometer gauge, which is also an American invention, will always determine the correctness or incorrectness of the fixed gauge. For instance, when a concern is using No. 12 wire, and is using a gauge that has become worn and enlarged, the question very naturally comes up as to the size of the wire. One size is apparently not large enough. This controversy may be settled at once by putting on the micrometer gauge. This is a very simple matter. I think this constitutes a good, simple, substantial mode of measuring wire. I don't think it is necessary to change it, only we ought to adopt one. If we adopt the English gauge we shall simply add confusion to the present confusion.

MR. HOTCHKISS—In respect to this matter and the standard agreed upon by different companies, Mr. Sise, of Montreal, is here, who has had experience in the matter of the purchase of the different wires made by companies on the other side. I would like to have him express his opinion as to what standard is now used in Germany or France. I will supplement any remarks he has to make by this statement: That I have been fortunate enough, as a Yankee manufacturer, to supply some of the foreign companies with wire during the past two years, and all of their specifications have called for a gauge which conforms with what is now called "The English Standard Gauge." I don't think it is a matter of importance whether a certain wire may be of this gauge or that gauge. They have some twenty odd gauges, if I remember, in the world. The question is of the diameter and the weight of it. That we must arrive at as the standard; and I think the best results may be derived, and they should recommend to this Convention to adopt that gauge which is now, as you might say, in universal use, outside of this country. And in that way we would bring ourselves into line with all other Telegraph and Telephone interests throughout the world. Mr. Sise probably knows something

as regards the character of the gauge as used by other Governments.

MR. SISE—We buy our wire altogether in England. Wycroft & Johnson, who supply the Government, had a separate gauge three years ago. They now have the new standard gauge, which is the only one now in England. If you order No. 9 wire in England and do not express the gauge, you will be sure to get standard gauge. In Germany, where we get a great many cases, the German Government has used exclusively the English standard gauge. We have our tables all inspected by the Superintendent of Telegraphs over there. In all his correspondence with us he mentions the new English standard gauge. In France they draw but little wire, as a general thing. Germany and England are furnishing practically all the wire on the Continent; and there the only gauge in use, unless some person for a special object orders another, is the standard gauge of England.

MR. DOOLITTLE—We should remember that the line wire is but a very small part of the general use of wire gauges in the electrical field. There is a very much larger number of sizes in copper wire, covering the different uses to which it is put, as, for instance, the different sizes of magnet wire, office wire, annunciator wire, line wire, etc. The confusion comes in more in the copper wire than it does in the line wire, on account of its great variety of sizes. I don't see that it affects us what they use in England. So long as we have adopted the American gauge, and it is well known, I don't see that it is necessary to go out of the beaten path and confuse the whole trade of the country as the consequence.

MR. SHIPPY—I think it is immaterial to this Association which gauge is adopted, because whatever gauge is adopted will come into general use here and will not be changed. In another part of the country a large manufacturing firm had a gauge upon which this question was considered and discussed for several weeks, and it amounted to nothing—there were so many elements of discord. There was a certain gauge which certain manufacturers had been using for

years, and they could not reconcile the differences, and the matter fell through. I would suggest to this Association to adopt any gauge now before us, so that it should be understood by the manufacturers that whenever a Telephone Company orders wire it shall be by that one gauge. I don't think it is material whether it is the old Birmingham or the new English, for the reason that the standard will be for this Association and not for the whole country.

MR. SARGENT—It seems to me that Mr. Doolittle has confessed that his predilection for the American gauge is a sentimental one. So far as the merits of the two gauges are concerned, I don't consider that there is any difference at all. If, as we have just learned, the fact is that the new English gauge is adopted in England and Germany, we could do no better than to follow the same gauge that they use, and it seems to me that we will not make confusion worse confounded by adopting this gauge. The fact is that every manufacturer has made a gauge according to his own sweet will. The only reform named is a new American gauge. Now, the largest manufacturers of wire are in England, and they have adopted this standard gauge, which is simply an improvement on the Birmingham gauge, which is more in use than any other gauge in the world. I don't think it is worthy of this Association to disregard what has been done in England, simply as a matter of sentiment, because we have got our own gauge and mean to have it in spite of everything. What we want is to have a gauge that is universal, and it is a practical question and not a sentimental one.

MR. DOOLITTLE—I simply don't want to break up the present system. We have for a quarter of a century endeavored to get into a general plan. We have nearly succeeded. If the electrical fraternity will adopt the American gauge, which is based upon the right principle, and which is the one that has been almost universally adopted in this country, we will help along the matter and arrive some time at a common system throughout the country in all branches of the wire business. But we cannot if we go branching off

into any other system now. It will simply introduce another element of discord.

MR. SARGENT—The manufacturers confess that it rests with us what the standard shall be. It don't make any difference whether we say that the English standard gauge shall be our standard, or the American. And I do not see why we may not just as well have the gauge that is in use in England, France and Germany as to take one of our own.

MR. BARTON—I am sorry that I have not been here within the last few minutes to hear what has been said. But at the risk of saying over again what some one else has said before, I will repeat what I was saying to Mr. Doolittle a little while ago: that it seems to me that an attempt to get one wire gauge for this generation will not meet with much success if we go at it by introducing still another new one. The people who use the wire gauges for sheet brass and for sheet metal in general, sheet brass in particular, use the Brown & Sharpe's gauge. They are used to it, and it will be a formidable undertaking to get them to discontinue it. The people who have adopted the new English standard gauge abroad have only adopted it in theory. It is not in use by the people who use gauges It is a theoretical gauge. Now if there were only two gauges to decide the thing, and we could get one by deciding between those two, the best thing we could do would be to adopt the new English gauge. It has some advantages over the American gauge, in that it has a certain sanction abroad. But in this country it has not begun to be used yet. My own idea is that, as the Browne & Sharpe gauge is largely used already, and as it will continue to be used for a good many years, we should only be working for posterity and not for ourselves, if we took any steps toward introducing still another new gauge like the new English gauge; and for myself I would sooner see a movement made to concentrate on the Brown & Sharpe gauge, as that is theoretically as good a gauge as the English gauge. It is built on the same principle, and the only advantage which the English gauge has over that, if

there were no other gauges, is that it stands some chance in a future generation of being adopted by the people of Europe. So I suppose the question is on the adoption of the English standard gauge. To make a step in the direction of using that will be perhaps a step in the direction of having a uniform gauge for the whole world after we are dead and gone; but it will introduce confusion for the next few years, during the time that we shall want to use the wire gauges.

MR. SHIPPY—I think there is one system of measuring wire that has not been sufficiently dwelt upon in this discussion, and upon which all the discordant elements can unite; and that is by measuring wire by thousandths of an inch. In all our experience for the past few years, where there was any question, or the party ordering the wire was particular as regards size, the diameter in thousandths of an inch was specified. Whatever gauge you adopt you will in practice have to fall back upon measurement by thousandths; and I suppose that inasmuch as this matter of measuring by thousandths is just as easy as any method, all our manufacturers will practically draw wire according to that standard.

MR. DOOLITTLE—I fully agree with Mr. Shippy, that so far as the leading companies are concerned, the large companies, like the American Bell, order wire now by one-thousandths of an inch. I use that method myself at present, but later on it may be desirable to use the metric system, which is deservedly gaining favor as a system of measurement, and should that prevail we would again be in trouble provided we adopted the new British standard. All things considered we had better continue and encourage the use of the American gauge which is so nearly established as a standard, and if any change is ever made it should be to the metric system. In a great many of our orders of line wire the size is given in one-thousandths of an inch in order to secure a given resistance, and weight per mile, and in such cases neither the American nor English gauge would be of any service. But there must be a gauge provided for

ordinary use—a common gauge, a fixed gauge, and that is what we are looking out for now. We must have something of that kind.

MR. LOCKWOOD—There was some discussion upon this subject this morning, and Mr. Sargent, who is one of the committee who has this matter in charge, read letters from certain manufacturers and others, in which the views of such gentlemen and corporations were given, and the letter from the American Electrical Works went so far as to say that they had given up attempting to fill orders by gauge. They were in the habit of denominating the wires (copper wires, of course, being meant by their term of "wires") by thousandths of an inch. In commenting upon that report I took occasion to say, what Mr. Shippy has also referred to, that no matter what gauge was adopted, it was probable that persons or corporations ordering wires in quantity would always say what size in thousandths of an inch they wanted, for what weight and for what resistance, "weight" referring more especially to large wires or line wires. What we have heard this afternoon seems to leave the conclusion that there is considerable difference of opinion, even among European authorities. Mr. Sise has ordered wires from England, and he has stated that when the gauge is not specified, the new Board of Trade gauge is always understood. Mr. Barton, on the contrary, from information which he has received, states that even the new gauge is only theoretically regarded as the standard; and yet it would seem that the testimony of a gentleman who has ordered wire in large quantities rather ought to have the preponderance. There is no doubt in my mind at all of the propriety of endorsing the views of the European countries in this matter. If it be to have uniformity, I don't think any gentleman here or any corporation represented here would expect, when he ordered a certain number or size of wire, to always get exactly what he ordered, unless he had specified the size in thousandths of an inch. It is natural that those who have given even the largest amount of thought to such matters should be liable to mistakes. You remember, even so great

a man as Sir Isaac Newton made a mistake once—a man who, if he didn't invent, at least discovered the laws of gravitation. I have no doubt that it will occur to you, gentlemen, that when that philosopher was about to make a house for his cat it didn't once occur to his mind that a cat and a kitten could go in through the same hole, and he gave instructions to his carpenters to have a large hole made for the cat and a smaller one for the kitten. When the house was completed he was very much surprised to find that the kitten went through the very same hole that the cat did. I don't think we can do any better than follow the lead given us by our European brethren, laying aside all prejudices as to what others have done. We shall lose nothing, except a little sentimental feeling in favor of Messrs. Brown & Sharpe.

MR. CALLENDER—I wish to say, in regard to the custom as to wire gauges in England, that no gauge is used at the factories there except the Birmingham. It is only in cases where a very exact measurement is wanted that thousandths of an inch are referred to.

MR. ECKERT—There are not half a dozen gentlemen in this room that could tell the difference in the different gauges if they were thrown into their hands. If we had a great many, 80 or 100, it might be hard to distinguish them. But now there are but two or three used, and for my part I don't see what you are going to gain by spending a great deal of time on this subject.

THE PRESIDENT—I would say, in the absence of other light, that as long as we can order wire of any dimensions we like, and the manufacturers will make it, it makes practically no difference what gauge we go by. It is a question for manufacturers rather than for ourselves. So long as the protective tariff remains in force in our country, so long will we buy our goods at home and order of our own manufacturers such goods as we require. If the tariff should be taken off, no doubt we would be buying foreign wires, and this question would become active instead of passive. Meantime, I should like to cast the vote of this Association in favor of gauge uniformity throughout the world, and uniform-

ity in weights and measures of all descriptions will be creeping into commerce, and is even now beginning to do so, as it has already crept into mathematics. It has nearly assimilated currencies upon the decimal system throughout the world. It seems to me that we ought not to delay, so far as our small influence goes, the adoption of a uniform standard gauge. If there are no further remarks, I will put the question on Mr. Sargent's resolution, which is now before the house.

MR. DURANT—What will be the effect of the adoption by this Association of a standard gauge? The question in my mind is, whether this resolution will bind the members of this Association to use that gauge exclusively.

THE PRESIDENT—I will call on Mr. Sargent for information in that regard. What is the intent of the resolution, Mr. Sargent?

MR. SARGENT—I don't see that it is binding on the Association, except so far as the Association would feel bound by its own rules. I think the Committee was appointed for a definite object and purpose, and that object and purpose was to offer the Association a standard gauge, which might be adopted. I have offered that, and have asked the Association to decide whether they will adhere to that gauge. I don't consider that we are bound, we merely give an expression of opinion that we are in favor of uni formity.

THE PRESIDENT—Some years ago the question arose in this Association regarding to what extent its resolutions or expressed opinions would be binding on the members in actual cases of controversy, and it was then generally accepted that the intent of the Association was to exercise influence rather than to pass binding laws.

MR. DURANT—I was going to say that, in thinking over this matter as to its origin, if I recollect aright, the object of referring this matter to a committee was to establish certain relations between the manufacturers and the telephone companies. In other words, the object of introducing that resolution was to secure a standard gauge for telegraph and

telephone companies in this country. Now, if that could be done—if the manufacturers could be induced to make only by those gauges, unless specially ordered to the contrary, we would remove all the difficulties that now come from difference of gauges in this country—and manufacturers say they are prepared to furnish any gauges we please. Now if all the Associations could be bound by the action of the Convention, it certainly would bring about a very desirable result. But if they cannot, I don't see that the resolution could have any effect at all. I would be in favor of adopting the new English gauge as being perhaps in the direction of removing, more speedily, confusion as it now exists, and of bringing about uniformity.

THE PRESIDENT—It is out of the power of the Association to bind any of its members as to any particular gauge. But a resolution adopted by the Convention would unquestionably influence the members in making their orders.

MR. SHIPPY—If a member of the Association orders wire to-morrow, I suppose it is by the new gauge. Now, if some of the members are not bound by the action of this Association and want some other gauge for their wire, and we furnish a wrong gauge, are we to stand the expense? If some one of our members did not agree to this resolution, and was not bound by it, and orders some wire of me by some other gauge than that adopted here, and I should send it according to the standard gauge, and he should say he didn't want that and send it back, who would be liable for the damages in such a case?

THE PRESIDENT—I think any judge would decide that you could not be holden unless the order specified the gauge.

MR. METZGER—It seems to me that unless you make it a legal standard trouble will arise, because by what gauge will the parties be governed? You must have either one thing or the other. I cannot see what good purpose is accomplished by the passage of that resolution, unless we can invest it with a legal sanction and make it the standard by law. If we formulate opinions of our own and pass a

resolution, it will not bind anybody. We want to get at something by which if a dispute arises between a party selling and a party buying, there shall be a regular and legal standard by which the controversy may be decided. That can only be accomplished by a general and uniform law. I don't see what good the passage of this resolution would do. If I wanted to order wire by the Birmingham gauge I would do so, and if I wanted to order it by the Brown & Sharpe gauge I would do so.

MR. SHIPPY—If you order No. 16 wire, there will not be a word said about the gauge.

MR. J. CHESTER WILSON—We seem to agree pretty fully upon the English standard gauge as desirable to be adopted by the Telephone Association. If we adopt it it will be a step in favor of popularizing a standard gauge. If we adopt the American gauge, there will be two standards in the world. By the adoption of the American gauge we cannot hope to obliterate the Washburn & Moen and every other individual firm's gauge, to do away with all gauges except the American. But by the recognition by this Association of the English standard gauge, we are working in the direction of one uniform gauge and not two. And so far as bringing the matter into any legal shape is concerned, there are other Associations that eight or nine years ago petitioned Congress in the matter, in a very respectful way, but there was never anything accomplished by them. But if this Telephone Association add its strength by setting the example and recognizing the English standard as our standard, then one step will be taken in the direction of the adoption of a universal gauge. I have had some experience in ordering wire and in filling orders. The best plan now is to order in thousandths of an inch. But it is American to say things in the shortest possible way. In ordering wire by telegraph we must spell out the message, and in using the words "thousandths of an inch," our message gets long and the figures get uncertain. I hope, therefore, that our vote will be strong for the new English standard gauge, simply as an independent move by the Telephone Association to show their independence and their desire for uniformity.

And let that step be towards actual uniformity, and not towards two gauges, the English as one and the American another. I hope that ultimately other Associations interested like the Electric Light Association and the Association of Railroad Engineers will follow this same lead, and it will be greatly to the credit of the Telephone Association if they shall be the first to take a step that shall be thus recognized as a desirable one.

THE PRESIDENT—The question is upon Mr. Sargent's resolution, which is as follows:

"*Resolved*, That this Association, so far as they can, will adopt the English standard wire gauge for their future work."

A vote was then taken, and the resolution was adopted.

THE PRESIDENT—There are some recommendations of the Executive Committee to be considered.

MR. HOTCHKISS—In connection with the resolution that has just been passed, I would recommend that a committee of two or three be appointed by the Chair to issue a circular to the members of this Association, containing a complete statement of the English standard gauge, informing them as to the diameter of the wire, and determining the weight per mile and the resistance of the same for both iron and copper wire. That, I am informed, has not yet been obtained by any of the European governments—as to copper wire more particularly. If I am wrong I should like to be corrected in the statement. As to iron, I think there is a table published by Messrs. Callender & Company, of London. I should like very much to have some committee appointed by the Chair upon these matters, and to fix for both kinds of wire both the weights and the resistances.

MR. SARGENT—I will second the motion, and say that it is in the right direction, because I think there are many members of the Association that are not familiar with the English standard gauge.

THE PRESIDENT—I would suggest that if Mr. Hotchkiss will withdraw that resolution, a simple instruction from the meeting to the Secretary to furnish such information will be all that is necessary. (Motion withdrawn.) It will be un-

derstood that the Secretary is instructed to forward, in circular form, a complete statement of the new standard English gauge, for the use of the Association, and the weights per mile of iron and copper, and the resistance per mile of each number of the gauge.

MR. DURANT—I suggest that it should be accompanied by the numbers in the old gauges, in other words, in that circular should be contained the Brown & Sharpe gauges and the Birmingham gauges.

MR. DOOLITTLE—I think we have too many gauges already. We are trying to get at uniformity. I have received communications and orders within the last few weeks that specified three different gauges, all meaning the same size. The parties did not know the difference between one and the other. The more tables you give the public or the purchasing agents, the more easily are they confused. In ordering wire the gauge desired should be mentioned in the order, for instance: "No. 14, American guage," then the dealer will at once understand the size required.

MR. CALLENDER—I would suggest that a committee be named by the Chair to communicate with other electrical societies, and give to this Society needed information derived from them in regard to these matters.

THE PRESIDENT—That might also be added to the instructions to the Secretary. It will be so considered, unless objection is made.

MR. BARTON—I suggest that motion be not limited to other Electrical Societies, but that the Secretary communicate also with the manufacturers and wire-drawers, to get them to reduce the new standard English gauge to common use, so far as they can, for sheet metal and for wire other than electrical wire. I think that will be a move in the right direction. We cannot expect to have the uniformity of gauges unless the gauge is the same for electrical wire and for wire that has nothing to do with electricity in any shape or manner.

THE PRESIDENT—I understand that the instructions to the Secretary are to communicate the standard English

gauge, in all its particulars, to the members, showing weights and resistances for iron and copper, and also that the Secretary communicate with electrical societies, taking the initiative in this matter and requesting them, so far as possible, to aid in furthering the adoption of the standard gauge.

MR. SARGENT—I don't think we ought to consult with the other societies. We can, as a matter of courtesy, notify them that we have adopted this standard gauge, and that we, of course, hope that they will follow the example. A consultation or conference of societies through committees is apt to prove interminable.

MR. DOOLITTLE—I beg to ask up to what size the memorandum, as to weights, etc., should be submitted to the members of this Convention by the Secretary?

THE PRESIDENT—The gauge is 1-36. How would that be? The new standard, as I have the memorandum given me, has run up from 7-0 to 22.

The next business is the continuation of certain recommendations from the Executive Committee. The first is as follows:

"That an assessment of $40 per member be levied and paid to the Treasurer of the Association, to provide for the expenses of the ensuing year, and that the Constitution be amended accordingly, making the annual dues $50 instead of $10."

As the Constitutional amendment cannot be acted upon until next year, it will be better to divide the report into two parts:

First—That an assessment of $40 per member be levied and paid to the Treasurer, to provide for the expenses of the ensuing year.

MR. SARGENT—The annual dues as at present were to be added to the $40. The assessment and dues would be $50 for the ensuing year.

THE PRESIDENT—I will read the recommendation as follows:

"The Committee recommend that an assessment of $40 per member be levied and paid to the Treasurer of the Association, to provide for the expenses of the ensuing year."

MR. STONE—How will that effect some associations carrying two or three memberships? Will they be expected to

pay $40 on each membership? Some of the members belonging to this Association have been charitable enough to carry two and three memberships.

THE PRESIDENT—Did not the discussion of last year define that matter?

MR. SARGENT—There were some who had inadvertently continued to pay for more than one vote. They never actually cast but one vote, but were entitled to the others all the same. The $40 would not be added to the $30. The intention is that each member shall have but one vote.

MR. STORKE—In thinking over this question of assessment, I have come to the conclusion to say to you that the Treasurer is satisfied, if members are not, that an assessment is necessary in order to keep the Association running. It seems to me that $50 is perhaps too much for some Companies to pay for a membership in this Association and too little for others; that perhaps a graded assessment might be arranged for which would fit all cases more equitably, and with that view, and to bring the matter before the Association, I will offer the following resolution:

"*Resolved*, That a Committee of five be appointed by the Association to apportion the expenses of the Association among the active and honorary members on some equitable basis of stations and business, and present the same to the Secretary, who will render bills in accordance therewith, the minimum of assessment being fixed at $25."

Since drawing this, it has been suggested that perhaps the Chair better appoint a Nominating Committee to present an Assessment Committee, to be acted upon by the Association. I think that five gentlemen can be selected who will at first figure out exactly what our expenses will be in running the Association, and then apportion that amount fairly among the different members. The aggregate will not be a very large sum, with the additional expense of the paid Secretary, who devotes his time, or a large portion of his time, to the business of the Association. I would offer that as a resolution.

THE PRESIDENT—I presume Mr. Storke wishes to offer that as a substitute for the recommendation of the Executive Committee now before the house.

MR. STORKE—I would offer my resolution as a substitute for that recommendation.

The resolution offered by Mr. Storke was seconded.

MR. METZGER—This question was discussed this morning by the Executive Committee, and it seemed to be the opinion of the Committee that the members of the Association should pay in accordance with the benefits they received from the Association. Now, when viewed from that plane, each company represented here receives equal benefits. I don't see why the Metropolitan Telephone Co. or the Central District Co., or any of the large companies in the United States should pay any more or any less than the East Tennessee Co., or a company whose territory is not so great and has not so many stations. It seems to me that the benefits derived through this Association apply equally to all, and that each should pay the same proportion of the expenses. Take a telephone company like the New England, with its great number of stations. I don't see why they should pay any more than we do, who have only half or quarter as many. I think that the benefits that our Company receive are as great as those that they receive, and we ought to pay as much.

MR. CUTLER—I cannot agree with the gentleman's remarks in regard to each member receiving equal benefits from the information derived from this Association. If a company has only a small number of subscribers it may get as much information as one that has a large number, but that information cannot be of as much benefit to it as if it had a larger field to apply it in. I agree with the spirit of Mr. Storke's resolutions, that each company should pay in accordance with its number of subscribers and the amount of its business—not wholly in accordance with its gross receipts, because I do not always think that is as equitable. There certainly should be a difference between the amount paid by a large company that has a large business, and that paid by a small company. I think any committee fairly appointed as this committee would be, would look at this in a reasonable light and make such assessments as were equitable.

MR. SHIPPY—Although, as an honorary member, I cannot vote on this resolution, I should like to second that part relating to honorary members. We are here by courtesy and we should pay our proportion of the burdens.

MR. HOTCHKISS—As one of the honorary members of the Association, I heartily endorse the remarks made by Mr. Shippy, that the honorary members be made to step up to the captain's office and settle for their share of proportion of the expenses.

MR. EASTABROOK—There is a point I was going to raise, as to whether we had the right to assess these honorary members. I was going to move to expunge this from the resolution. If the Constitution is as I understand it, I will not be a party to assessing people that we have no right to assess.

MR. STORKE—I had not looked at the Constitution when I was thinking of getting some money out of these honorary members. But I must say for the credit of these honorary menbers who have spoken out in meeting, and whom I have talked with personally, that they had not only expressed a willingness but a desire to contribute towards the expenses of this Association.

MR. LOCKWOOD—It occurs to me that if honorary members pay their contribution to the expenses of the Association they should also receive some of the honors of the Association, and be allowed to vote for the privilege of assessing themselves. I have no particular financial interest in the matter myself, because there is a "bloated monopoly" behind me. Some of the honorary members may not be so "well fixed." They would like the privilege of paying and also the privilege of voting, no doubt. We might as well while amending the Constitution in one particular amend it in both, and then the distinction will cease.

MR. KELLER—As representing the New England Company, I don't see why we should pay more than Mr. Cutler's Company, or any other.

While we may receive more benefits, it is possible that we may impart more benefits. (Laughter.)

MR. METZGER—I think the Constitution provides that the Executive Committee shall have power to make assessments. In that case, the motion of Mr. Storke would be out of order.

MR. STORKE—The Constitution, Article 18, provides: "An honorary member shall have no vote in meetings, and shall be subject to no dues or assessments." The amendment adopted at the Chicago meeting, 1881, provided that "The Association may make assessments upon the members thereof, and such assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and members may vote either personally or by proxy." My resolution is exactly in conformity with the Constitution.

THE PRESIDENT—This matter of membership is a matter of ancient history. At the time the Association was first formed we did not know what perils the Association was going to meet with in its voyage through the ages, and we feared that these honorary members who were manufacturers, Alexander Graham Bell and Mr. Vail and other dark and designing persons, might at some future time imperil our rights and sow dissensions in our councils, and prove obnoxious as voting members of the Association. Therefore we shut them out, and very justly said, that, being deprived of power, they should be exempt from taxation. We followed the American principle of "no taxation without representation." Originally each member of the Association was entitled to as many votes as he operated exchanges, and an exchange was rather vaguely defined as "limited to the corporate limits of the city or village," and it was supposed at the time that there would be some great benefit derived by a member of the Association from casting a great many votes. After one or two meetings that fallacy passed away, and these members who voted a great many times found the cost a great many dollars, and gradually begun to surrender these voting privileges. Mr. Stone's company valued them and held on, but the others generally surrendered them and paid on but one vote, $10 per annum.

I thought one or two seasons ago to correct that and make the dues uniform, but for some reason or other the matter was delayed and was never acted upon. There is hardly a company here to whom the tax that we pay would be a burden. At the same time, I think it would be equitable and fair, and in the way of ordinary good fellowship, that the companies should pay somewhat in proportion to their means. I should give my voice for a distribution of that character.

MR. HOTCHKISS—Following out the suggestions made by different members and by our worthy Chairman in regard to giving the honorary members of this Association a vote, assuming that your hypothesis is correct that the active membership, as to votes, has been and probably will be decreased gradually, you would make this Association an Association of honorary members — of manufacturers rather than of telephone interests—if you allow these honorary members to cast a vote, I should say that, on my part, and I shall be, I think, seconded by other honorary members here, we ought to be assessed as honorary manufacturers, and not allowed any voice in this meeting as to votes. I can understand that some honorary members of this Association are members of it through courtesy of the Association, as they had no particular interests to sustain; but I think the manufacturing element among the honorary members should be assessed, and allowed no voice in the meeting.

MR. EASTABROOK—I am quite sure that there is no gentleman here who would ask a person to his house as his guest, and then ask him to pay for the cigars that he furnished.

THE PRESIDENT—This Association was intended to be, and is at present an Association of Telephone Exchanges, and as such it ought not to let its expenses be borne by the manufacturers. Are there any further remarks to be made? The question is now on Mr. Storke's substitute.

MR. SARGENT—I move that the word "honorary" be taken from the resolution.

MR. STORKE—As the resolution was originally written, the word "honorary" was not there. The suggestion that it be

incorporated came from an honorary member, who desired to share in the burdens of the Association. I feel, as Mr. Eastabrook does, that in one sense it is "crowding the mourners" a little to tax these honorary members. At the same time we did tax them in the beginning, as we taxed ourselves.

THE PRESIDENT—Allow the Chair to interject here the statement that the Secretary has discovered the first amendment to the Constitution which, I think, bears on the discussion of this subject. The amendment was passed at the Chicago meeting in April, 1881. It provides that "the Association may, by resolution adopted by a majority of all the votes of the Association, make assessments upon the members thereof, and such assessments shall be uniform and equal, and based upon the number of votes to which each member may be entitled at the time such assessments are made."

Mr. Storke's resolution provides that a committee be appointed to graduate the assessments. That is contrary to the Constitution. We have got to take the facts as they are. I believe there are only two or three companies that are paying on more than one vote.

MR. STORKE—That amendment would give us the absolute right to make a graduated assessment, as I read it; and it was intended to do that.

MR. TYLER—The amendment which has just been read leads me to raise a point of order, and ask a ruling of the Chair. I raise the point of order that the amendment is in conflict with the Constitution, with this interpretation of that clause of the Constitution that "on the number of votes to which they are entitled" means "to which they are entitled by the annual dues which they pay." A member is entitled to one vote for every $10 of annual dues. He may take one or forty according to the number that he pays for. I ask the Chair to rule on the point of order that that being the interpretation of the clause of the Constitution, the motion is out of order.

THE PRESIDENT—The Chair agrees with Mr. Tyler, and

believes that the membership on which members will be assessed under this amendment is the membership which they have paid the last assessment upon, and the Chair would, therefore, rule Mr. Storke's substitute out of order. Is there an appeal taken from the ruling?

MR. DURANT—I move that an assessment of $40 be levied on the members to provide for the expenses of the ensuing year.

MR. TYLER—Before the question is finally put I wish to offer an amendment.

MR. DURANT—I will withdraw my motion.

MR. TYLER—The motion before the House is to adopt the recommendation of the Executive Committee in so far as it provides for an assessment of $40 upon members. I appreciate the facts stated by Mr. Storke and Mr. Cutler, that there are companies, members of the Association, to whom, in the present condition of their business, this may be more of a burden than they feel called upon to bear. I therefore move you, as an amendment to the motion of Mr. Storke, that it be in the power of the Advisory Committee of this Association, upon cause shown of the assessment being burdensome, to remit to any member of the Association not more than $20 of this assessment. No company will come before this Advisory Committee and ask for this remittance of assessment unless they see the need of it. But if they do need it, and it is burdensome, by this provision it can be brought down to $30.

THE PRESIDENT—Do you desire to incorporate that as an amendment to the report of the Committee?

MR. TYLER—Yes, sir.

THE PRESIDENT—The amendment is seconded. The question is upon its adoption. The amendment is this:

"That the Advisory Committee be authorized by the Association to remit, upon application of any company, such portion of the assessment provided for by the resolution as they deem equitable, not to exceed $20."

A vote was taken and the foregoing amendment was adopted.

THE PRESIDENT—The question is now upon the re-

commendation of the Committee, as amended, viz.: That an assessment of $40 be levied upon the members and paid to the Treasurer, to provide for the expenses of the ensuing year.

MR. CUTLER—Under the ruling of the Chair, some companies would be obliged to pay $120. The Constitution provides that any assessment made must be in accordance with the number of votes paid for at the last meeting.

THE PRESIDENT—The Association can authorize the Treasurer to remit such portion of the assessment as they deem equitable.

MR. METZGER—It says: "On the basis of the number of votes to which the member may be entitled at the time such assessments are made."

MR. CUTLER—The basis must be the number paid for at the last meeting.

THE PRESIDENT—The Chair has ruled upon the matter. The only way is for the Association to authorize the Treasurer to refund what they have overpaid.

MR. STONE—It would not be in order to substitute any other business for that now before the house. But if the members of the Association will permit me, I would like to give notice, in order to save any complication that might be brought about, that the City and Suburban Association would like to resign two of its memberships. I don't desire to do anything that will complicate this matter.

THE PRESIDENT—The Chair will put the question upon the recommendation of the Executive Committee with the amendment of Mr. Tyler, which has already been adopted.

A vote was taken, and the recommendation of the Committee as amended was adopted.

MR. STONE—I desire to file a notice that the City and Suburban Telegraph Association resigns two of its memberships. I only do it for the purpose of preventing any complication which might arise.

MR. SARGENT—There are two companies that pay on three votes, and two companies that pay on two. The record will show that.

MR. TYLER—I would ask whether the dues of these companies for the first of July have been paid?

THE TREASURER—Only a portion of them.

MR. TYLER—Then it is entirely in their power to correct that before the close of this meeting.

THE PRESIDENT—The next recommendation of the Executive Committee now comes up for action. That is in the form of a constitutional amendment, and must therefore be read, and comes up for action next year. The Committee recommend that the Constitution be amended so that the annual dues shall be $50 instead of $10. If the Association please, that recommendation will be filed by the Secretary as a motion to amend the Constitution, made by the Chairman of the Executive Committe, and as such will come up next year.

The next recommendation of the Executive Committee is as follows:

The Committee recommend the advisability of employing a paid Secretary, at a salary not exceeding $100 per month, and that the Constitution be amended so as to provide for the appointment of the Secretary by the Executive Committee.

Does that mean that the Executive Committee shall appoint the Secretary instead of making him an elective officer of the Association?

MR. SARGENT—That was the object.

THE PRESIDENT—We will then separate the two parts of the recommendation and offer first the following:

The Executive Committee recommend the employment of a paid Secretary at a salary not exceeding $100 per month.

MR. DURANT—I suggest that that be worded differently, recommending that the salary of the Secretary be fixed at a sum not exceeding $100 per month.

THE PRESIDENT—I think that is a good suggestion.

MR. DURANT—I would say, for the information of the Association, that the Executive Committee have been heretofore in the habit of fixing the salary of the Secretary. They have authority for it. The Secretary has been elected, so that the question of salary was entirely within the discre-

tion of the Executive Committee, and this discussion has had the effect of laying before the Association the desire of the Committee to employ a paid Secretary at such a salary. I think it would be well for those members of the Executive Committee who made that suggestion to state their reasons for so doing, if they have not already done so.

MR. TYLER—The officers of the Association for the last two years have been impressed with the fact that there was a work that might be done by some officer of the Association for which there was now no place. We have heretofore elected a Secretary, who had all he could do between the sessions of the Association, without working in the collection and distribution of statistics other than those contained in the reports and papers presented at the meeting. But we have felt that the existence of a Secretary who devoted the whole or the larger part of his time to the interests of the Telephone Exchanges throughout the country, with permanent headquarters either in Boston or New York, a man upon whom we could always put our hands, and who was paid to answer questions, collect information, assist in all sorts of ways, generally, in the business of the Association, would be a very great help. So we made this recommendation. And we say, very frankly, that the selection of General Barney as Secretary for the ensuing year, was made with the expressed view, taking into consideration the fact that General Barney expects to be so situated that he can do this work, and is willing to do it, and is willing to be paid for it. Consequently, I don't know as anything more is necessary for the Association than to pass a vote of approval of such plan of the Executive Committee. A vote of approval passed now would authorize the Executive Committee and General Barney to proceed in the way proposed, and notice to that effect would be given to members of the Association through the published report.

THE PRESIDENT—It might be put in this shape: The report of the Committee can first be accepted. Are you ready for the question? Will you accept the report of the Executive Committee as to the employment of a paid Secretary?

MR. SARGENT—The report was accepted this morning.

THE PRESIDENT—Mr. Tyler moves a resolution approving the suggestion made by the Executive Committee. Is that resolution seconded?

MR. DURANT—The statement of Mr. Tyler, and the wording of that resolution implies two persons, first, the Secretary of the Association, and then another Secretary to be employed by the Association in the work of collecting and distributing statistics, etc., and that the Constitution be amended to provide for the appointment of a Secretary by the Executive Committee.

THE PRESIDENT—We have not got to that point yet. That is a constitutional change for next year. All those in favor of the resolution providing for the employment of a paid Secretary, at a salary not exceeding $100 per month, will express it in the usual manner.

The resolution was adopted.

THE PRESIDENT—Now comes the recommendation of the Executive Committee that the Constitution be amended to provide for the appointment of the Secretary by the Executive Committee. If no objection is made, it will be recorded that the Chairman of the Executive Committee offered an amendment to the Constitution providing that the Secretary be appointed by the Executive Committee for the ensuing year instead of being elected by the Association. That will come up for action next year.

MR. CUTLER—I would like to ask how it is to be understood—whether the Executive Committee of last year would appoint the Secretary for the coming year before they retired from office, or whether it would be the other way?

THE PRESIDENT—It should be "for the ensuing year."

The motion, as adopted, is: That the Executive Committee recommend the adoption of an amendment to the Constitution, providing that the Secretary shall be appointed by the newly elected Executive Committee, instead of elected by the Association, as formerly. The matter is laid over until the next meeting, under the rules.

MR. STORKE—I offer the following as an amendment to

the By-Laws, covering the duty which we now intend shall be performed by the Secretary:

Art. III. Sec. 5.—The Secretary shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the Telephone business as have heretofore been furnished by the various committees of this Association.

THE PRESIDENT—Mr. Storke offers an amendment to the Constitution, setting forth the duties of the Secretary, and adding to those duties the compiling of such reports as have heretofore been compiled by the various committees. That will lie over till next year, under the By-Law requiring thirty days' notice.

MR. TYLER—I think that ought to be a little broader; because the Executive Committee may suggest other forms and other statistics.

THE PRESIDENT—At the last meeting there was adopted this amendment to the By-Laws:

"ARTICLE X.—At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Chairman shall be *ex-officio* Chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require."

It does not seem that it is necessary to appoint that committee now. Hereafter, if the Secretary requires assistance, which must be rendered by some members of the Association, he can inform the President, and the committee can then be appointed.

MR. SHIPPY—I would like to extend an invitation to the honorary members of this Association to meet in Room 5, immediately after adjournment.

MR. CARSON—The Pawtucket Thread Company has sent an invitation to the members of the Convention to visit their factory at No. 9 Callender street, Providence. This is simply an announcement for the information of the members.

On motion of Mr. Sargent the invitation was accepted, with thanks.

The Convention adjourned to meet on Wednesday, September 9th, at 10 o'clock A. M.

SECOND DAY'S PROCEEDINGS.

MORNING SESSION.

WEDNESDAY, Sept. 9th, 1885.

The National Telephone Exchange Association re-assembled in the parlors of the Narragansett Hotel, on Wednesday morning, at 10 o'clock, the President in the Chair.

THE PRESIDENT—The first business is the special order—the report of the Special Committee on the date and place of meeting for the next year. Mr. Carson is Chairman of that Committee.

MR. CARSON—I am able to state that the report of this Committee is unanimous. There will be no minority report; and the report represents the sentiment of the entire Committee, in recommending the first Tuesday in September of next year, for the meeting at St. Louis.

The report of the Committee was unanimously adopted, and the Convention voted to meet next year at St. Louis, on the first Tuesday in September.

THE PRESIDENT—Is there any new business to be introduced?

MR. HALL—I desire to give notice of a desired amendment to the Constitution. In looking over the list of persons present at the meeting, I find that we have forty-one active members and thirty-one honorary members. The admission to honorary membership of manufacturers or individuals interested in the objects of this Association has reached a point where they constitute almost an equal number with the active members, and I think it was not intended at the outset that the honorary membership should take the form that it has, and I propose an amendment to the

Constitution which will re-arrange our membership and bring it into the form customary in all Associations of this kind, that is: That we should have the regular members of the Association; that we should have associate members, composed of persons who are interested in the objects of the Association, but not directly in the line of our own occupation. I propose to amend Article 17 of the Constitution, so that the first section will read as follows:

"SECTION 1. Any person may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such election to be by ballot."

I propose to add a new section, as follows:

"ARTICLE 18.

"SECTION 1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

"SEC. 2. An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments."

THE PRESIDENT—The Chair would like to make one suggestion in regard to that amendment, and that is: That the amendment defining the qualifications of associate members should read about as follows:

"Any person or corporation actively interested in the objects of this Association and *not owning or operating Telephone Exchanges*, may become an associate member of the Association by a vote of the majority of the members present at any regular meeting."

As I understand it, Mr. Hall's wording would leave it optional with an exchange company to be either an honorary or associate member.

MR. HALL—Mr. President, your suggestion would exclude such a company, for instance, as the Bell Telephone Company, of Canada, from associate membership.

THE PRESIDENT—I would suggest that this is simply a notice of an intention to amend, and it can be laid over until the next meeting and carefully considered in the meantime. When the time for action arrives, such verbal changes as may seem necessary, after a year's consideration, may be

introduced. Notice will be filed with the Secretary, and it will come up for action at the next meeting.

Is there any further business? If not, the papers prepared for the Association will now be called for. The first paper is entitled "Some Practical Results of Long Distance Telephoning." It is contributed by A. S. Hibbard, Superintendent of the Wisconsin Telephone Company.

MR. LOCKWOOD—May I interrupt the proceedings for one minute? I should like to propose for honorary membership the Standard Underground Cable Company, of Pittsburgh, Pennsylvania.

MR. HALL—I have no objection to that Company's coming into the Association, as all other manufacturing companies have come in. But I think that the Constitution does not permit incorporated companies to become members. The reading is, that "any *person* actively interested in the objects of the Association may become an honorary member." I think we have done wrong in making any corporations members. I don't think it is constitutional at all.

MR. LOCKWOOD—While I think corporate organizations have heretofore become members upon the same terms that the Standard Underground Cable Company now wishes, I don't desire to press the point; and as an alternative for my former proposition, I now propose the name of George L. Wylie, of New York, as an honorary member of this Association.

A vote was taken, and Mr. Wylie was unanimously elected.

THE PRESIDENT—Mr. Sargent will now proceed with reading the paper on "Long Distance Telephoning."

MR. SARGENT—Mr. Hibbard sent this paper, with regrets that he could not be present at the meeting, and requesting me to read it for him.

Mr. Sargent then read Mr. Hibbard's paper, entitled "Some Practical Results in Long Distance Telephoning," as follows:

SOME PRACTICAL RESULTS IN LONG DISTANCE TELEPHONING.

Since the first introduction of the Telephone, its possibilities as a "far speaker" have been subjects of most engrossing interest. Scarcely had the results of the first crude experiments in telephoning been made public, when in

all parts of the world there were heard the most fabulous tales of the new wonder. Distance was to be entirely annihilated, and oceans and continents traversed by the subtle current, which at even the greatest extremes of distance was to reproduce articulate speech.

Conversations were with the utmost ease to be carried on by telephone, the speakers being thousands of miles apart.

It was almost suggested that the life of the average American would be incomplete were he to omit from his daily routine the pleasure of telephoning to his friends in Japan.

Our friends in New York, over their breakfast coffee, were to have from London oral cognizance of what was most thoroughly "English," on that same afternoon, echoed—at the turn of a switch—by the midnight songs of the seals at the Golden Gate.

The precise advantages of these results were not stated, but, in the usual newspaper phraseology, it required only a slight perfecting of the last and most unimportant details to accomplish all that had been stated, and far exceed the expectations of the most sanguine.

It is needless to state that the results which have followed have not fulfilled these first predictions.

The wide-spread publication of imaginative successes has, in deceiving the public, robbed the laborer in this field of any laurels he might hope to obtain by making his accomplishments appear tame in view of the marvels advertised for his art.

In contemplating this particular line of improvement the average American evidently intends to be surprised at nothing. You furnish him with a satisfactory oral communication two hundred miles, and his comment is, "H-m, well, that's pretty good, but when are we going to talk to Australia?"

It is most fortunate that in the developments of this branch of the art itself there is enough of interest to outweigh any temporary discouragement.

It is thought that, in 1877, the first successful long line results were obtained in experimental tests over telegraph lines.

During the following year many short telegraph lines were equipped with telephones as private lines, and as such were successfully used between stations five to fifty miles apart.

In 1878, or 1879, the extension of extra territorial lines or toll-lines was begun in a most unpretentious and economical manner by individuals holding licenses from the American Bell Telephone Company.

The "bean-pole" and "barn-top" lines were largely introduced, and, in too many cases, a faulty construction resulted, retarding in a great measure the development of successful long line systems.

In these days the stability and success of the telephone, as a business venture, were entirely problematical, and capital was slow to seek on the highway (the avenue so recently all but abandoned by successful telegraph companies) an investment for profit in long line telephoning.

It was soon demonstrated that telephones for exchange purposes were becoming a business necessity.

Companies were organized and capital invested in the remodeling and permanent improvement of exchanges. Extra territorial lines were built along

highways in all parts of the country, and developments in all branches of the business made with the most rapid strides.

To-day the well-known results of six years' work are exhibited in a showing of 1,252 exchanges, 134,847 subscribers, 539,388 exchange connections daily, 25,766 miles of poles in toll-line, 35,631 miles of wire, 18,330 toll connections daily.

From a business standpoint, the first question which arises in reference to an investment in a toll-line is: "Will it pay?" While the many and complex answers which we receive to this question make it impossible to apply one ruling to all cases, still enough can be shown from results obtained by different companies to obtain a good general idea of such investments.

For purposes of comparison I desire to submit some deductions from information kindly furnished by a number of companies largely interested in the business.

The figures in the following statement are based on results obtained from plants which are designated as individual toll-line systems, consisting of one or more main lines and their feeders. For instance, taking one main line connecting three to five sizable telephone exchanges, together with the branch lines or feeders running into them.

The Chicago Telephone Company shows a main line plant of No. 14 copper wire from Chicago to Elgin, Ill., 62 miles, consisting of four wires and connecting four exchanges and twelve toll stations on the direct line circuit. The cost of this plant is $12,800, or about $51 per mile of wire. The gross earnings of this main line plant for 1884 were $5,986, or $24 per year per mile of wire. Connecting with this system are four feeders, aggregating 100 miles of wire and connecting eight offices. The cost of the feeders was $8,662 or $86 per mile. The gross earnings of the feeders for 1884 were $1,363, or about $16 per mile. The expense of maintenance of this entire plant of 348 miles of wire was $821 for the year, or $2.36 per mile of wire, 4 per cent. of the cost of the plant and 11 per cent. of the gross earnings. The average number of messages, daily, over the main line is 96, making the daily average per wire, $24.

The Wisconsin Telephone Company reports a main line plant of No. 8 iron wire from Milwaukee to Oshkosh, 110 miles, connecting three exchanges. The cost was $8,369, or $76 per mile. The gross earnings of the main line plant for 1884 were $3,980, or $36 per mile of wire. Seven feeding lines connect with this main line, aggregating 225 miles of wire, and reaching seventeen offices. The cost of the feeders was $9,650 or $42 per mile. The gross earnings of the feeders for 1884 were $4,287, or $19 per mile. The expense of maintenance of the entire plant of 335 miles of wire was $194 for the year, or fifty-seven cents per mile of wire, or 1¾ per cent. of the cost of plant, and 2¼ per cent. of the gross earnings. The average number of messages daily over the main line was forty-nine.

The Telephone and Telegraph Company of Michigan reports a main line extending from Detroit to Saginaw, 100 miles long, on which No. 12 copper wire is used. The original cost of the line was $5,000. Two offices are connected on the main line, being the two terminals. The gross earnings of the main line for the year 1884 were $2,423, or $24 per year per mile of wire. The

length of the feeding lines is reported as ninety miles, connecting seven additional offices. The original cost of the feeders was $5,445, or $60 per mile. The gross income of the feeders for the year 1884 was $990, or $11 per mile of wire. The expense of maintenance of this 190 miles of wire for the year 1884 was $300, or $1.60 per mile of wire, 3 per cent. of the cost of the plant, and 8 per cent. of the gross earnings. The average number of messages daily transmitted over the main line is reported as forty. It will be noted on the above that the original cost of the construction of the 100 miles of copper wire is exceedingly low, averaging only $50 per mile.

The New York and New Jersey Telephone Company report systems of toll lines averaging in cost about $113 per wire; reporting the expense of maintenance at about $3 per annum per mile of wire.

The Bell Telephone Company, of Buffalo, reports a main line running from Buffalo to Rochester, being eighty-five miles of No. 9 iron wire connecting seven offices. This line cost $8,500, or $100 per mile. The gross earnings for the year 1884 were $2,400, or $28 per mile. The expense of maintenance is reported as $100, or $1.18 per mile, and the average number of messages daily over the line is thirty-three.

It was supposed that the preferable plan for investment was to connect the large business centres together by main lines, and then to extend feeding lines connecting tributary towns and villages with this system. This plan has certainly proved to be correct.

The toll business is gathered from the smaller tributary towns, and is most profitable in messages sent to the large exchange centres.

Thus the representative systems to-day are found to be in radial lines centreing in some local metropolis, and in main trunk lines connecting two or more such centres, together with their branch lines or feeders.

The limit of distance, in practical and profitable working, is about 100 miles, although a considerable business is done over 150 to 200 miles of wire.

The exchanges which show the greatest amount of average profit in toll business are those ranging from 100 to 500 subscribers. Cities of from 10,000 to 50,000 population appear to hold that peculiar business relationship with the surrounding country which is most essential to toll telephone business.

Exchanges of 100 subscribers show monthly reports of $300 in toll business; others of 1,500 subscribers report about $1,200 to $1,500. Sustaining its proportion the latter exchange should report $4,500 instead of $1,500.

The question of earnings, however, depends so much upon local influences that it is quite impossible to produce any general average representative of the results in all parts of the country.

The question of rates has not been treated uniformly by all companies. Many have endeavored to meet the telegraph rate in all cases, and to cut it on short lines. Others charge higher rates in almost all cases. A "square" rate based on county lines has prevailed to some extent, while a "direct distance rate" has also been found quite satisfactory. A minimum rate of 25 cents, and a maximum of 50 cents prevail very generally. The rate is based on the use of a wire for five minutes or less. It is shown that the average length of time of a toll message, after the parties get together, is two minutes. The average time spent in calling and starting messages is much longer than this.

The number of messages per day depends entirely upon the number and size of the exchanges and towns connected. Two exchanges of 100 subscribers each will seldom show a daily average of over twenty messages per wire on the toll line connecting them. In practice, therefore, twenty messages a day between two offices may be said to cover the average busy line. At 25 cents each, less 20 per cent. for extra territorial and operating expenses (a low estimate), the wire will earn four dollars ($4) per day. Computing the cost of construction at seventy-five dollars ($75) per mile, it can be easily figured how much of a line it is profitable to build, with an earning capacity of two dollars ($2) a day for each exchange connected. The conclusions reached will depend largely upon the rate of interest at which we wish to invest our money.

A number of telephone companies have tried, in different forms, what has been known as the toll-ticket plan. Coupon tickets, redeemable in toll-line service, have been issued to parties interested in the extension of lines. If the citizens in a town or village are desirous of securing telephonic communication with a neighboring county, town or metropolis, they are asked to purchase toll-line tickets to the amount of, say fifty dollars ($50) per mile for the line to be built, as evidence supporting their statements that the line will pay. If the sum so advanced is applied to the construction of the line, it is quite likely to pay well, especially after the first year. It is proven, beyond a doubt, that toll-lines on which an issue of tickets is made are used very much more than those built without it. Subscribers holding toll-tickets show an interest in the toll-lines, and a desire to use them, that has not been reached in any other way. The toll-ticket is certainly seductive, and, as a means of getting people into the habit of using toll-lines, it cannot be excelled. It may also be added that the dead-head toll-ticket has a potent charm for the legislator, the county roadmaster, the underground-wire alderman, the old woman whose cow is killed by lightning on the telephone wire, and sundry other personages. Considered from all its points, the toll-ticket is evidently quite a good thing.

Soon after the construction of the first long lines there came reports of mysterious noises heard in the telephone. At one end of the country statements were made that the croaking of bull-frogs and the singing of birds made serious disturbances, while in another locality it was held that the interferences were caused by the sighing and moaning of the wind. After a while the term "frying-pan noises" was adapted to the general disturbances, and later still, they were resolved under the head of induction. By whatever name these disturbances may be called, they still remain the most perplexing and annoying feature of long-line work. In dry and cold weather—particularly during the winter months—long lines are practically free from disturbances. With the advent of warm weather, however, comes a series of buzzing, crackling, frying and other noises on the lines, which prove a most serious interruption. It is almost impossible to obtain any definite information in regard to these troubles or their remedies. It has been remarked that the laws of inductive disturbances are not similar in any two States. Some companies report a serious loss in business on account of noisy wires, while others fail to notice any such troubles. The introduction of resistance into the circuit has been found beneficial in suppressing inductive disturbances, but has, in a

corresponding degree, weakened the telephonic effect. Leaky lines have been found less noisy than those well insulated.

Variations in temperature, cloud effects, sudden changes of barometer, velocity of wind, direction of line wire, and many other things have been mentioned as causes effecting noises on long wires. Up to the present time it has appeared quite as impossible to remedy the bad effects as to control the causes which we hold accountable for them. The most natural and general remedies which suggest themselves are a louder transmitter, and a less sensitive receiver; a receiver which will be affected only by the particular current governed by the transmitter worked in conjunction with it. As members of a large and growing family of licensees we will endeavor to have faith in the efforts of our indulgent parent, the American Bell Telephone Company, to supply this existing want.

Another surprise in long-line work was the discovery that when two wires were strung on one line of poles the inductive effect of one to the other was, in many cases, so great as to make it impossible to talk on both wires at one time. The effects of this "cross-talk" have varied exceedingly in different localities. Some companies report that they have educated their subscribers so that they do not mind it. Others find it a serious difficulty. As yet no satisfactory remedy for the trouble has been found. It is thought, however, that a minimum effect in cross-talk is obtained where one line is attached to glasses, well insulated, and the other attached to a bare pin or bracket. Opinions differ on this result. It has been proven beyond dispute, that the best wire for long lines is that of the smallest diameter and of the lowest resistance.

Soon after this conclusion was reached, the hard-drawn copper wire was perfected and introduced largely. The best results which have been obtained in long distance telephoning have been over this hard-drawn copper wire. It is fortunate that at this time the price of copper wire has been largely reduced, making it possible to use the wire extensively. In the Northwestern States the complete cost of a line of No 12 (Brown & Sharpe) copper wire, with thirty poles to the mile complete, is about seventy-five dollars ($75) per mile. In the same territory such a line, free from extraneous noise, and from all office resistance (annunciator coils, etc.), can be worked with excellent results a distance of 250 to 300 miles. It is both wise and profitable in the construction of a copper line, to employ experienced and careful linemen; to avoid straining or twisting the wire; to solder all connections, and to avoid the use of pliers, eccentrices or other tools in pulling up or tying. In long-line work it is also found advantageous to keep the wire clear of annunciator coils, ring-off drops or electromagnets of any kind. Such coils have a retarding effect which is most disastrous.

In the practical operation of long lines in connection with telephone exchanges, one of the most important features is the attention and co-operation of an intelligent operator. This is particularly necessary in making prompt connections and disconnections, and also in what is called "getting the parties together." Time is a most valuable ingredient in toll-line work, and much valuable time on the line may be lost by an inattentive operator. It has fallen to the lot of the toll-line operators to educate the public in the use of long lines, and it is only after very many admonitions to "stand closer to the instrument,"

"talk a little louder," and "go ahead," that the present proficiency (?) has been reached. Happily the good work is still going on, and the pupil is keeping pace with the improvement in his means of communication. In that bright future to which we look forward (the days of the loud transmitter, and the receiving telephone, which attends strictly to its own business), we may also see the patient subscriber waiting his turn on the wire, saying, "please," to the operator and settling his toll bills without a murmur.

No better evidence of the newness of the toll-line business can be furnished than reference to the widely differing results obtained in various parts of our own country. It cannot be said that the experimental stage has yet been passed. No settled policy has been developed. It has yet to be shown upon what basis very long lines can be operated at a profit. This is the problem yet to be solved. It is due to the most commendable enterprise of the licensees in this country that the present stage in the development of long lines has been reached, and the steady application of this enterprise will ultimately accomplish the desired end. The inventive genius of the world is straining every nerve to produce the "far speaker;" the network of lines and wires doubles and trebles in extent each year. Cities, towns, villages and hamlets are awakening to the fact that inter-communication is indispensable. No such pressure was ever before brought to bear on any one department of business. For the solution of this problem the public looks to the American Bell Telephone Company and its licensees in the United States. It is with much confidence that I venture the opinion that the expectation will be satisfactorily and speedily realized.

A. S. HIBBARD.

THE PRESIDENT—Gentlemen, will you remark upon the paper?

MR. STORKE—I would like to inquire if the "cost of maintenance," reported upon the several lines mentioned, simply includes any repairs that may have been necessary on those lines, that is, whether it includes any expenses, except those which, in the system of book-keeping adopted by the different companies, may have been charged to the "repair account" of the different lines. I judge that they are all new lines. Certainly, the copper lines have all been built within a very short period, and any idea of the amount of the profit of the business, based on that simple statement of "repairs," would carry us back to two or three years ago, when the "boom" was on, and we supposed every dollar brought in under toll-lines was clear profit. I have found that the entire cost of operating reaches from 50 to 60 per cent., and that without making any allowance for depreciation. When we started this toll-line business, years ago, starting from the

exchange centre we ran out lines ten, fifteen or twenty miles, and received from those lines very large returns. The business was done practically by the exchange people. The exchange repairmen looked after these short lines. As the money was paid for toll it was paid cheerfully and promptly. We counted it all as profits. I doubt very much if the full amount that should be charged to toll line expenses has really been placed there, in the reports made to Mr. Hibbard.

MR. EASTABROOK—I move that the paper of Mr. Hibbard be spread upon the records, and that the hearty thanks of the Association be tendered to him for his valuable and interesting paper.

The motion was seconded and adopted.

MR. SARGENT—I would answer Mr. Storke's question—that I judge from the way Mr. Hibbard has treated the figures furnished him in regard to our company, that by the term "maintenance" he means simple line maintenance. Probably he applied the same rule in the case of all the companies which he exhibits in detail.

THE PRESIDENT—That is true in the case of the Chicago Company. He has given the actual cost of maintaining the line entirely separated from the exchange repairs.

MR. LOCKWOOD—I don't know whether any other subject before this Convention will bring up for discussion the subject of inductive and other disturbances; but as Mr. Hibbard has mentioned it in his paper, I think it quite proper to allude to it here. There are these sources of disturbance, and the number of the disturbers is increasing, or seems to be, from year to year. All those which Mr. Hibbard has mentioned I think we have probably canvassed, and if we will go before the New York Underground Commission I have no doubt that we shall be told there that there are numerous remedies, all of which are equally perfect. But when we inquire into that a little more we find that every gentleman who there proposes a remedy is quite sure that only his own remedy is *the* one, and that everybody else's, including the remedy of David Brooks, is quite the

reverse. I don't think that I have any additional information to give upon that subject. It is one thing to know why these disturbances are produced, and form theories upon what they are, and quite another thing to produce not only remedies which will accomplish the object, but remedies which are commercially practical, and not only practical but practicable. But I would like to call the attention of the Association to one or two new sources of trouble that have arisen this year. One, which some of you are doubtless familiar with, is that resulting from the so-called method of inducting from stations to moving trains. Those of us who have tried to talk, or who have talked upon the New York and Boston line will remember that there is occasionally—say at intervals of about twenty seconds, when this method of induction is going on—a loud screaming noise, something like the crowing of a rooster, or something like a steamboat whistle. It varies a great deal; but while it is going on it is absolutely impossible to hear anything. That is a metallic circuit. And sometimes it varies again, and is like a horn. It has more emphasis and is louder than any telephonic communication we can have. Gentlemen doing business down in Connecticut are especially troubled with it. I don't know that we are the ones to apply a remedy to this matter. I think it should be the duty of the Association to bring to bear every means they possibly can upon other electric organizations, to induce them to keep as far as they can from the telephone wires. Mr. Hibbard made an attempt in this direction at Chicago, but was put down by the statement that there was no such thing as induction, and that, if there was, it did not affect telephones, and that electric-light people ought to know, of course. *We* know that there *is* such a thing as induction. It is not altogether a bad thing. In every Blake transmitter, or every Edison transmitter, we have an induction coil. If it was not used we should make very bad work in telephoning over half a mile. That should prove to all that there is such a thing, and that it has a certain effect.

Another source of electric disturbance has been brought

to my attention since I have been here, by Mr. Wilson, Superintendent of the Chesapeake and Potomac Telephone Company, at Baltimore. He says that there was in that city a short electric railway established, and that telephone wires, even across the street from this electric railway's conductors, suffer most terribly from a noise altogether unlike anything he has heard before, a noise loud and frequent, and very harassing and annoying to the ears of subscribers and also to telephone men. While the average subscriber's ear is very sensitive to such noises, and it is very difficult for him at times to hear the conversation of his distant friend under the most favorable circumstances, it is something new for the telephone man himself to be troubled. I may, perhaps, suggest what will doubtless occur to many others who have considered the subject, that if there are but one or two wires so troubled, if it is not convenient to move the line out of that vicinity altogether, and the offender cannot be induced to move or stay away, the best way would be simply to use a return wire (not necessarily a metallic circuit), but a circuit grounded at the central office, extending out through the district affected and then brought back and ending at another ground in the central office, and the difficulties of connecting metallic circuits will in that event be done entirely away with, the farther end being used as a permanent ground. The gentleman from Baltimore is here, and can add to my statement.

MR. WILSON, of Baltimore—We have a noise somewhat similar to that produced by the horn of the Rapid Telegraph Company. It is a squeaking noise. The trouble is when the motor is running on the road.

MR. METZGER—What is the distance between the track and your line?

MR. WILSON—They are very near together. The track is not in the centre of the road but on the side of it. It comes from the electric motor.

MR. DURANT—Is it an elevated road?

MR. WILSON—No, sir.

MR. LOCKWOOD—How far does the railroad conductor run by the side of your wires?

MR. WILSON—Of a distance of about two miles and a half.

CAPT. STONE—Did you say they were changing their route? I am an unfortunate stockholder in that road, and want to know something about it.

MR. WILSON—They have, I think, decided to stay.

CAPT. STONE—It is still in its experimental stage, and I am under the impression that they will fail to make it a commercial success. I was simply inquiring about the matter a little for my own information, and did not suppose it would very much interest the Association.

MR. HALL—I would like to ask Mr. Wilson whether he has tried the return circuit. He stated he had tried some experiments.

MR. WILSON—We have tried none but the metallic circuit.

MR. HALL—Have you not tried the return circuit? My own impression is that that would remedy the difficulty.

MR. CALLENDER—I don't know whether I should be in order if I describe to you a few experiments that we have recently made to overcome such induction as Mr. Wilson complains about on his telephone lines. We laid down an underground conduit 175 feet long. In that are three electric-light circuits, furnished by three Houghton machines, 25 lights each. Into that conduit we laid a telephone cable. At one end of the conduit junction boxes were placed, so that the wires could be brought back and each circuit can be made closing in 40 feet. The first test was a positive wire, coming from one of the machines and going to the conduit and then taken home. A telephone receiver was put to one of the wires of the cable, and as soon as the electric current comes, of course the buzz of the noise is very great. A negative wire was then put in so that the metallic circuit was complete. The buzz of the telephone was not so great as it was before. The second electric light circuit was then put on and the buzz was still further increased. Our object in doing that was to get the maximum amount of disturbance that we could upon our telephone line, and having

got that, to do away with that and make our wire quiet. The principle we took was that of a common return wire for a certain number of conductors. The cable was composed of a No. 12 central wire, and around it were wound eight wires of No. 20 old gauge. When the telephone, as I said before, was put to the 21 wires, and each of them grounded, induction was very great. But when one was cut out of the circuit altogether and the central wire was used as a return circuit, there was absolutely no noise at all on the telephone. The receiver was as still and quiet as it is possible to have it. Then several more instruments were put in. Four more instruments were put in altogether, and it was found that the same quietness reigned over the whole cable. Two of these circuits were talked over at the same time, and there was no "cross-talk" nor any disturbance set up from one to the other; I tell you how we arranged our cable and our test, perfectly frankly. We are simply searching in the interest of science, to see whether this arrangement of the one common return circuit for the number of wires is going to have the desired effect. But it seems to me that Mr. Wilson's trouble would be overcome if he was to use a metallic circuit.

MR. STORKE—The distances mentioned in the report on which the lines have been successfully operating, rather exceed those in my experience, even over copper wire. I would like to have some of the gentlemen present, who have had experience with these lines, state how far they are able to work practically without repeating. Our experience is considerably within one hundred miles.

THE PRESIDENT—Is there anybody here from the Michigan Telephone Company, or the Bell Telephone Company, of Buffalo? Mr. Storke asks for information as to how far long lines work satisfactorily.

MR. COWLES—In regard to our lines from Buffalo out, I have to say that the line between Buffalo and Rochester is about ninety miles long. At some times during the day we can hear conversation between those two points. But even at that distance of ninety miles we don't consider it a good

commercial line. I don't think we have any lines in our territory where we can carry on a fair business correspondence at any distance over sixty miles. So I should say that, in our experience, the commercial limit is sixty miles; although we do talk, and in the course of the day we have a number of messages where the conversation is carried on over a distance of 100 or 150 miles, without repeating the messages; I would not say a great many, but fifteen or twenty messages during the day. You might look over our lists at night and find a dozen or fifteen that were carried on over that distance. I have always claimed in our reports and in conversation, that any line we have got not over sixty miles long, ought to give us a good report of conversation.

MR. SISE—We have a main line of about 800 miles. We are working about 3,000 miles of what we call trunk line; and the best work we get is on our old lines before we adopted copper wire—No. 9 wire, with cross-arm without insulator. We are getting very good work with 150 to 200 miles daily.

MR. HALL—I would like to say that we have one of the new long distance telephones connected from this hotel to the Providence central office, and from there by metallic circuit to Boston, or New Haven, or any intermediate point. I should be glad to have gentlemen interested in the subject go to the instrument in my room and call for any point they wish to try on those lines, and use the lines. At the office in New York and, I think, in Boston, and at the office in Providence there is one of the new transmitters, and one here to talk into. So you can get the trial from the transmitter, both in using and speaking and hearing from the other end of the line; and you can try it on the short line here in this city, on the long line to Boston, and the still longer line to New York, the latter being about 250 miles long.

THE PRESIDENT—Mr. Fowler, of New Orleans, has some long lines. I see he is here, and we would like to hear from him.

MR. FOWLER—The Great Southern Company have added quite a number of lines within the last nine months. Con-

spicuous among them is one of 138 miles, including two intermediate exchange systems, carrying on the same poles about 114 miles of steel wire operated as feeders to this line. We also have another line, 120 miles in length, of No. 10 iron wire, operating through three cables, the longest one of which is about 3,200 feet, across the Mississippi river. We have made a test over these two wires running laterally on the opposite side of the river. We talk through these three cables and an aerial suspension of 110 miles very satisfactorily.

MR. SARGENT—I would like to ask Mr. Sise and Mr. Fowler whether the lines they have described are not worked through an unsettled country?

MR. SISE—As mine are located in Canada, I think that is evident.

MR. FOWLER—We are running laterally and intermediately between railroads, the right of way of which is largely occupied by the Western Union Telegraph Company. The country between is well settled, but not so well settled as you find it north. There are plantations and settlements all the way.

MR. SISE—We could not go on to the railway, or within a long distance of them. There is one feature that is causing us a great deal of trouble. The matter of maintenance has not been very slight. But the matter of collecting is a very serious one. We are doing twenty-five cents worth of book-keeping to get a twenty-five cent message sent. If we could arrange a form of blank for collecting these tolls, we should do better.

MR. METZGER—Are there any cables on these long lines?

MR. FOWLER—On one line there are three cables, and on the other there are no cables. There is one other thing that I would like to call attention to. I attribute our exemption from disturbance and "cross-talk" on the lines I have spoken of to natural causes. These lines are constructed running parallel to, and in portions immediately over large tracts of water, the Mississippi river intervening between the two, and adjacent to the river there are large

tracts of rice fields which, during the summer and the heated term, are flooded with water.

MR. MCCLUER—Before the subject is left, I would like to say that the experience that I have had with long lines has been on two wires, one from Charleston to Point Pleasant, and the other from Richmond to Petersburg. The first line is forty-five miles in length, and is a private line with seven stations on it. Repeatedly, in my business, I have conversed over that line and noticed that there was not one particle of inductive disturbance, and I have been told by parties who used it habitually, that it was very seldom that they noticed any disturbance from earth currents or electricity. On the second line there are few times that we can use the line satisfactorily. Sometimes we can, however. It has occurred to me that the fact of the Charleston and Point Pleasant line running parallel with the Conway river, would relieve that from disturbance from earth or atmospheric electricity; and the other, running at right angles with the course of the James and other rivers flowing into it, would perhaps account for that line being disturbed to that extent. I have also thought, and would like to ask if other gentlemen have noticed it, that the geological formation of the crust of the earth has a good deal to do with that. If our lines run in a certain direction with reference to the metalliferous veins near them we would experience a great deal of difficulty from earth currents, and in other instances not any. The idea has occurred to me a great many times, but I have never had an opportunity to compare notes with any one who has a sufficient amount of experience, on a sufficient number of lines, to have their attention called to it. I would like to know from Mr. Lockwood, or others present, if they have ever noticed anything of the kind. I think we could derive a great deal of information that would be of benefit to all of us from a discussion of that point.

MR. LOCKWOOD--Although not an electrician, I would like to observe that it is doubtless true that all these causes which have been mentioned have something to do with the

troubles we have all experienced; and I think that it is quite certain that one of the principal causes of trouble that we have is the fact that many wires do cross the magnetic meridian, and are fulfilling the function of a Siemens' armature in the magnetic field of the earth. If there were only one magnetic wire between the two poles of the earth, we probably should not notice the effect, but when we multiply that wire by a great many stretches, in the same direction we get the same effect as we do with the Siemens' armature. It seems almost useless to recapitulate over and over again these several causes of trouble, whether earth currents or atmospherical electricity. But it is very certain that by continually thinking upon these matters and noting the different phenomena that occur from time to time in different parts of the country, and communicating our views freely to one another, we shall be able to crystallize them at last into a comprehensive form, and different remedies will be suggested, which can be easily applied and which will commend themselves to us by their simplicity and their practicability. For the benefit of the Association I may say that I am, although not altogether for the benefit of the Association, when my other duties will permit, compiling an entire list of all the remedies proposed and all the theories proposed, for the trouble, and I hope at some future meeting to be able to submit the same in a complete form, when we may perhaps put our heads together and adopt some remedy which shall be based upon the troubles as they are presented in the aggregate and based upon the remedies which have been from time to time suggested. I think that would be most desirable to accomplish, and have been doing this work in the interest of the American Bell Telephone Company. When it is finished it will be at the service of all of us, and I have no doubt we shall all be benefited.

MR SARGENT—It don't seem to me that we need to look to such remote causes as metalliferous veins for these difficulties. I cannot believe that such a vein would have much effect—considering the immensity of the earth as a conductor—any more than some little inequality in the size of a

length of copper wire made by a careless drawer would have any effect upon the current passing over it. The immensity of the earth as a conductor is so great that the difference between its electricity and that of a metalliferous vein is not worth mentioning. There are more tangible causes.

MR. LOCKWOOD—I don't mean that a vein of metallic ore running parallel with the wire would *cause* induction on telephone wire, but that it would *relieve* it to a certain extent; that instead of the currents produced by induction or atmospheric electricity passing over our wire they would take the metalliferous earth in preference. And in the same way I look upon the fact of the line parallel with the river being relieved as being due to the fact that the river itself offered nearly as good a passage as the wire for those extraneous currents.

MR. STORKE—I would like to ask Mr. Keller, taking Boston as his centre, what is the limit for long-distance telephoning under ordinary conditions of the lines?

MR. KELLER—I would say that we talk from forty to fifty miles. That is about the limit. Sometimes we get a very good talk with Portland, which is 110 miles; but I don't think subscribers could use it with any degree of satisfaction at all. We talk to the office in Portland quite often. We are now building a copper wire between Boston and Portland that we hope to be able to use for commercial purposes. That remains to be seen, however. We regard it somewhat as an experiment. It is No. 14, Brown & Sharpe's gauge.

MR. STORKE—I would like to ask Mr. Sargent the same question about New York and Brooklyn?

MR. SARGENT—The New York and New Jersey Company have a copper wire from Jersey City to Trenton, which is the way the wire runs, about 65 miles. The route is rather circuitous. There is no difficulty whatever in working that wire between Trenton and Jersey City. But there is difficulty when we connect on the cable crossing the river from Jersey City to New York. There is comparatively little business between Jersey City and Trenton, so that we

don't get any commercial results over that wire. But it is a good practical working wire.

MR. STORKE—I would like to ask Mr. Metzger the same question about Pittsburgh.

MR. METZGER—The longest talking line that we have, that we use commercially, is 100 miles. It is No. 12 copper wire, insulated entirely from one end to the other. It is between Pittsburgh and Wheeling. We talk to Wheeling, but it is not a great commercial success. I think that 100 miles is about the limit in our experience.

MR. BAILEY—I would like to ask Mr. Sargent if a metallic circuit is proved to be a cure for all ills that telephones are liable to, and if so, why that is not a proper way to circumvent them all? I should not think the expense of duplicating all the wires should be a bar to it, if it could be made a success commercially.

MR. LOCKWOOD—It is not altogether a metallic circuit which gives us the modicum of success which is obtained. A metallic circuit is of no use unless the wires composing it are equidistant. I remember in the early days of the telephone, when telephonic science was supposed to have its principal abiding place in Boston, a gentleman wrote to the American Bell Telephone Company, and said his subscribers had great trouble in talking over a 30 mile line. Mr. Watson recommended a metallic circuit, without specifying the nature of it. The gentleman thought he would combine financial economy with the improved telephoning, and he brought his metallic circuit around into more country, and put up more stations. He wrote back that it worked worse than it did before. He was then informed that the wires should be parallel with each other and equally distant from the disturbing source. When the wires are so placed, it is a practical cure for nearly every telephonic ill. It seems that the great difficulty, in addition to upsetting the existing system, is that it involves new difficulties in calling and signaling, and in all the practical manipulations of the exchange. But I think the expense is the chief deterrent consideration.

Mr. BAILEY—Do I understand that one line of poles is

limited to one metallic circuit? Can you have two metallic circuits on one line of poles?

MR. LOCKWOOD—Yes, sir; quite a number.

MR. STORKE—Won't you get induction between the metallic circuits?

MR. LOCKWOOD—I think not.

MR. BAILEY—Suppose you had 15 or 20 all working at the same time?

MR. LOCKWOOD—I don't think there would be the slightest interference, because whatever induction there might be would be exerted in two ways at once.

MR. STORKE—Have you any special plan for running more than one wire on a line of poles?

MR. LOCKWOOD—I think Mr. Hall or Mr. Doolittle could speak better than I could in regard to that. I don't think there would be the slightest difficulty, providing the wires were nearer to each other than they were to any others.

THE PRESIDENT—Time is passing, and we must go on to another subject, unless there is something of peculiar importance to be elicited in this discussion. If so, it should be stated now. Mr. Bailey inquired whether there was any difficulty in stringing more than one line of wire on the same line of poles.

MR. HALL—We have no line on which there is more than one. But from the metallic circuit and a single wire there is induction. If there is an induction from a metallic circuit to a single wire, I don't know why there would not be from a metallic circuit to a metallic circuit. I think that it is a matter to be worked out in practice before we shall know satisfactorily about it.

MR. FROST—I can say that we have a metallic circuit running from New Haven to New York, running parallel to an iron wire, and you can hear very distinctly when they are both in use.

THE PRESIDENT—If there are no further remarks, I will make an announcement in regard to the excursion to Leicester. There are two trains which leave Providence, one at 6:55 A. M., and one at 7:30 A. M. It is desired to know the preference of the Association.

A vote was then taken, by rising.

THE PRESIDENT—The preference of the Association seems to be in favor of the later train. The trains leave Worcester to return at 1:40 P M. and at 4 P. M. We will now listen to Mr. Sunny's paper on "Exchange Statistics."

Mr. B. E. Sunny, of Chicago, then presented and read the annual paper on "Exchange Statistics," as follows:

MR. PRESIDENT AND GENTLEMEN—I have to present to you the statistics formerly compiled by the Committee on Exchange Statistics and Switch-boards. Notwithstanding no special effort was made to get reports from exchanges of below 50,000 population, because of their number and the belief that the reports from the larger offices would show sufficiently the drift of the business, exchanges representing 54,000 subscribers have reported, as against 50,000 last year.

There are forty-two exchanges of over 50,000 population, representing, in round numbers, 60,000 subscribers. Of that number, twenty-seven exchanges, representing 40,000 subscribers, have reported.

The Central Union; the Missouri & Kansas; the Pacific Bell, and the Southern New England Companies send no reports. They all include in their respective territories large and important exchanges, and it is to be regretted that, with one or two exceptions, none of the companies named have, since the organization of the Association, found it convenient to part with any information for a report of this character. The meeting of last year tried to touch the hearts of these obdurate gentlemen by resolution, but without avail. It is hoped that a more heroic remedy may be found and applied, so that at the next session they will overwhelm us with information.

Table No. 1 gives the population, the number of subscribers, and the ratio of subscribers to inhabitants. As usual, the United States Census of 1880 is used as a standard.

TABLE NO. 1.

EXCHANGE SUBSCRIBERS.

Cities of over 150,000 Population.	Populat'n census '80	Ratio.	Sub'rs, 1885.	Inc. over '84	Sub-scribers 1884.	Sub-scribers 1883.	Sub-scribers 1882.	Sub-scribers 1881.
Baltimore.....	332,313	204	1,630	180	1,450	1,220	1,017	926
Boston.....	362,535	214	1,696	.....	.....	.....		.....
Brooklyn.	566,663	241	2,354	508	1,846	1,601	801	108
Buffalo.....	155,134	101	1,533	113	1,420	1,208	1,047	990
Chicago.....	503,185	138	3,630	404	3,246	2,903	2,596	3,054
Cincinnati.....	255,130	101	2,535	297	2,238	2,099	2,056	1,741
Cleveland.....	160,146	98	1,620	3	1,617	1,507	.....	.....
New Orleans....	216,180	190	1,153	.....	.....	.....	.....	.....
New York.....	1,206,209	229	5,252	444	{ 4210	3,576	2,873	2.747
New York, Law,	.....	.....	.....	.....	{ 598	582	578	.....
Philadelphia....	847,170	366	2,310	111	2,199	2,013	.....	.....
Pittsburgh.....	247,765	148	1,688	.....	.....	.....	.....	.....
St. Louis.....	350,518	229	1,528	156	1,362	.....	.....	.....

EXCHANGE SUBSCRIBERS—*Continued.*

Cities of from 50,000 to 150,000 Population.	Populat'n census '80	Ratio.	Sub'rs, 1885.	Inc. over '84	Subscribers 1884.	Subscribers 1883.	Subscribers 1882.	Subscribers 1881.
Atlanta, Ga.....	37,409	60	618	195	423	.....	.....	.....
Albany.....	90,758	77	1,158	16	1,142	1,076	1,100	1,058
Detroit.....	116,340	59	1,956	256	1,700	1,474	.....	.....
Louisville.....	135,000	166	1,271	.....	.....	.....	.....	.....
Lowell.....	59,485	74	800	.....	.....	.....	.....	.....
Milwaukee.....	115,587	84	1,375	212	1,163	960	.....	.....
Paterson	51,031	78	651	100	551	473	.....	.....
Providence.....	104,857	48	2,162	270	1,892	1,745	.....	.....
Richmond.....	63,300	149	427	73	354	347	.....	.....
Rochester.....	89,366	110	808	82	724	607	549	.....
Worcester.....	58,295	75	777	.....	.....	.....	.....	.....
Washington.....	144,293	127	1,138	366	872	.....	.....	.....
Jersey City.....	120,722	187	648	247	391	346	.....	.....
Denver.....	35,629	.....	751	28	723	680	620	.....

The balance are offices of below 50,000 population, and there are too many of them to read. Of course they will be printed in the report.

Ten Exchanges reporting this year and last, and having in 1884, 18,408 subscribers, in 1885 have 20,408, an increase of 2,000, or eleven per cent. Brooklyn alone gained 508, while New York gained 444, Chicago 404, Washington 366, and Cincinnati 297. Cleveland and Albany gain three and six respectively.

The next table, No. 2, shows the average number of connections daily. The business of twenty-two offices is given, and ten compared with previous years.

TABLE NO. 2.

DAILY CONNECTIONS.

City.	1885.	1884.	1883.	1882.	1881.
Atlanta.....	4,724	4,421	.....	.....	.....
Albany.....	8,326	8,258	7,543	4,593	6,582
Baltimore.....	10,481	.....	.....	.....	.....
Boston.....	10,385	.....	.....	.....	.....
Brooklyn.....	10,809	5,508	4,741	.....	.....
Buffalo.....	5,980	5,480	5,290	3,842	2,304
Chicago.....	31,368	27,101	22,000	16,044	16,136
Cincinnati.....	16,000	.....	.....	.....	.....
Cleveland.....	16,213	10,769	13,460	.....	.....
Denver.....	4,467	5,298	4,179	3,450	.....
Detroit.....	20,800	.....	.....	.....	.....
Milwaukee.....	4,461	.....	.....	.....	.....
New Orleans.....	6,791	.....	.....	.....	.....
New York.....	36,153	21,579	18,858	13,935	10,271
New York, Law.....	.....	4,333	7,033	5,792	.....
Omaha.....	3,695	2,711	.....	.....	.....
Portland.....	3,577	.....	.....	.....	.....
Philadelphia.....	15,136	19,145	14,770	.....	.....
Pittsburgh.....	11,583	.....	.....	.....	.....
Providence.....	12,046	.....	.....	.....	.....
Richmond.....	4,072	3,013	.....	.....	.....
St. Louis.....	9,168	.....	.....	.....	.....
Washington.....	3,939	2,782	.....	.....	.....

Ten of these exchanges reporting in 1884 and 1885, in 1884 handled 108,631 connections daily, and in 1885 136,086, an increase of 25 per cent. in one year. New York has increased 15,000 a day; Brooklyn, 5,000, or double that of last year; Cleveland, 6,000, notwithstanding the increase of only three subscribers; and Chicago, 4,000. On the other hand Philadelphia with an increase of 111 subscribers falls off 4,000, and Albany and Denver show a slight falling off.

Table No. 3 gives the average daily calls per subscriber. The daily use of each telephone is twice the number of calls, as given below.

TABLE No. 3.

CALLS PER SUBSCRIBER.

City.	1885.	1884.
Atlanta	7.6	10.5
Albany	7.	7.2
Baltimore	7.	6.8
Boston	6.	.....
Brooklyn	4.5	3.6
Buffalo	3.9	4.3
Chicago	8.6	8.4
Cincinnati	6.	9.6
Cleveland	10.	6.6
Denver	6.	7.3
Detroit	10.6	.....
Milwaukee	3.2	.....
New Orleans	5.9	.....
New York	7.	5.1
New York, Law	.....	7.2
Philadelphia	6.5	8.
Pittsburgh	6.8	.....
Providence	5.2	5.
Richmond	9.5	8.8
St. Louis	6.	.....
Washington	3.5	.....

As will be noticed, the Detroit subscribers believe in getting their money's worth, and call ten and six-tenths times daily. Cleveland comes next with ten calls, and Chicago follows with an increased use of two-tenths of one call daily. In New York last year's report gave the Law Company seven and two-tenths calls, and the Metropolitan Company five and one-tenth. This year the report is consolidated, and gives New York seven calls, which is a handsome increase. Albany, Buffalo, Cincinnati, Denver, and Philadelphia show a falling off.

Table No. 4 shows the number of connections lost or delayed for the three important reasons "Busy," "Don't answer" and "Trouble." The different methods governing exchanges adopted to suit the flow of the business in the several localities, rather preclude the possibility of making any comparisons. Where we would naturally look for a large amount of delayed business we do not find it, and *vice versa*, as the following table will show:

TABLE No. 4.

LOST OR DELAYED CONNECTIONS.

City.	1885.		1884.	
	No.	per cent.	No.	per cent.
Albany	179	2		
Baltimore	900	9	800	8
Boston	618	5		
Brooklyn	506	5	634	11
Buffalo	446	7	520	9
Chicago	2,759	8.7	1,355	5
Denver		6		
Detroit	2,120	10		
Milwaukee	892	20		
New Orleans	426	6		
New York	1,959	5½	1,789	8
Portland	270	7		
Philadelphia	390	2.5		
Pittsburgh	1,085	10		
St. Louis		5		
Washington	777	1.9	602	20

Milwaukee has the heaviest percentage, which is explained by the repeated calls in the morning hours for railroad offices that are busy. Washington is nineteen per cent., Pittsburgh and Detroit each ten, and Baltimore nine. New York and Chicago are only five and one-half and eight and two-tenths per cent. respectively. It is true of Chicago that the subscriber calls but once for the party, and if he be busy the connection is made when he is disengaged, if not for three hours. It is found that this is highly satisfactory to the subscriber, and relieves the operator from answering calls for the same party several times. It incidentally keeps an immense quantity of profanity out of the transmitter that is apt to get there if the subscriber must ask ten times for what he wants once. New York evidently does the same with this class of connections.

Next in order is Table No. 5, showing the number of connections daily per operator. Seventeen offices are mentioned; ten compared with last year.

TABLE No. 5.

CONNECTIONS PER OPERATOR.

City.	1885.	1884.	1883.	1882.
Atlanta	469	1,021		
Albany	324	392	503	353
Baltimore	390			
Boston	375			
Brooklyn	277	177	132	
Buffalo	233	221	263	148
Chicago	290	271	202	161
Cincinnati	200	218	295	262
Cleveland	209	175	263	

CONNECTIONS PER OPERATOR—*Continued.*

City.	1885.	1884.	1885.	1882.
Denver	291	360	379	246
Detroit	710	.....	.....	.....
Milwaukee	281	203	269	.....
New Orleans	848	.....	.....	.....
New York	255	145	120	114
New York, Law	.....	481	575	526
Philadelphia	337	147	267	.....
Philadelphia, Law	.....	609	.....	.....
Pittsburgh	526	.....	.....	.....
Providence	335	.....	.....	.....
Richmond	958	639	.....	.....
St. Louis	283	.....	.....	.....
Washington	387	.....	.....	.....

The offices working on the multiple system—eight in number—average 387 connections per operator. The remaining nine, not multipled, average 268 connections per operator. Albany, Cincinnati and Denver are making less connections per operator than a year ago.

In the next Table, No. 6, is indicated the number of wires per operator.

TABLE No. 6.

SUBSCRIBERS PER OPERATOR.

City.	1885.	1884.	1883.
Atlanta	68	106	.....
Albany	58	63	72
Baltimore	71	85	30
Boston	63	.....	.....
Brooklyn	71	68	48
Buffalo	70	67	67
Chicago	33	34	31
Cincinnati	31	34	32
Cleveland	34	33	33
Denver	53	51	56
Detroit	70	.....	.....
Milwaukee	91	64	46
New Orleans	144	.....	.....
New York, Law	39	29	23
New York	.....	66	56
Philadelphia	50	37	38
Pittsburgh	65	.....	.....
Providence	64	.....	.....
Richmond	108	88	.....
St. Louis	51	.....	.....
Washington	126	.....	.....

Eight Multiple Boards average 73 subscribers per operator; nine boards not multipled, fifty wires per operator.

To make Table No. 7 a little more comprehensive, I have figured the average

cost of one hundred connections, exchange pay roll only instead of one connection. The old saw admonishes us to look out for the pennies, but says nothing about fractional parts thereof. Therefore, the cost of one connection is not likely to make an abiding impression on the memory, while we can, with a small effort, remember the cost of one hundred connections.

TABLE No 7.

COST OF CONNECTIONS.

Exchange.	Cost of 100 Connections.		Cost of one Connection.			
	1885.	1884.	1885	1884.	1883.	1882.
New Orleans	.15		.0015			
Detroit	.21		.0021			
Providence	.23		.0023			
Baltimore	.25	.40	.0025	.0040	0058	.0072
Albany	.30	.65	.0030	.0065	.0089	.0050
Cleveland	.31	.50	.0031	.0050	.0060	
Boston	.38		.0038			
Brooklyn	41	.69	.0041	.0069	.0098	
St. Louis	.44		.0044			
Milwaukee	.46	1.13	.0046	.0113	.0055	
Chicago	.48	.54	.0048	.0054	0064	.0073
Pittsburgh	.51		.0051			
Washington	.51		.0051			
Denver	.55	.77	.0055	.0072	.0075	.0044
Buffalo	.64	.60	.0064	.0060	.0047	.0072
New York	.66	.66	.0066	.0066		

Buffalo pays four cents a hundred more than a year ago. New York shows no change, while the others have cut down materially.

The table giving the time on ten consecutive connections is worthy of considerable confidence. While the harping critic—if we had one—might think he saw a weak spot or two in it, the confiding majority would unquestionably down him.

TABLE No 8.

TIME OF CONNECTIONS,

City.	1885.		1884.		1883.		1882.	
	1 office.	2 offices	1 office.	2 offices	1 office.	2 offices	1 office.	2 offices
Atlanta	2.17		3.40					
Albany	3.7	3.48						
Baltimore	3.27							
Boston	2.20	12.5						
Brooklyn	4.49	6.47	10.45	10.45	10.	12.		
Buffalo	3.20	5.05	6.	8.15	7.	9.30	5.13	9.47
Chicago	7.	8.	7.5	11.38	10.50	14.36	20.30	29.45
Cincinnati	23.							
Detroit	3.5	8.						
Milwaukee	4.48		4.15		9.			
New York	2.20	3.40						
New York, Law	1.40	2.20						
Pittsburgh	10.31	10.42						
Providence	14.		7.50	12.	9.10	14.20	13 48	18.45
Richmond	2.9		4.25					
St. Louis	2.53	4.52						
Philadelphia	5.8	13.40						

You will notice that the six offices on the multiple system make about the same speed, except Pittsburgh, where time is six minutes slower. New York reports the fastest time on record on the Law board, and as fast time as Boston on the regular board. Cincinnati bobs up smilingly at the bottom of the list, while Providence is content to be seven minutes slower than last year. The showing as a whole is very gratifying, indicating as it does from year to year great strides in the direction of speed and efficiency. There is no other industry in the world that is expected to get so much out of one little minute as the Telephone Exchange, and that we are able to do it is something to be thankful for.

The number of trunk lines as shown in table No. 9 is increasing rapidly. Since last year nine offices have increased from 1,393 to 1,712, or 23 per cent.

TABLE NO. 9.

NUMBER OF TRUNK LINES.

City.	Trunks.			
	1885.	1884.	1883.	1882.
Albany	75	50	69	55
Boston	152			
Brooklyn	126	104	89	
Buffalo	45	37	26	21
Chicago	355	254	245	228
Cincinnati	309	199	312	277
Cleveland	144	40	63	
Detroit	20			
New York	520	491	331	274
New York, Law		106	59	20
Pittsburgh	39			
Philadelphia	101	56	74	
Providence	37	42	38	48

Providence alone shows a decrease. One hundred and seventy-five of the Chicago and a large number of the New York trunks are multipled.

Table No. 10 tells of the necessity for increasing the number of trunks, and shows an increased daily use as compared with last year.

TABLE NO. 10.

TRUNK CONNECTIONS.

City.	Daily Connections per Trunk.				
	1885.	1884.	1883.	1882.	1881.
Albany	61	72	56	48	66
Boston	24				
Brooklyn	33	22	28		
Buffalo	36	39	50	41	21
Chicago	56	38	56	47	48
Cincinnati	29	8	21		
Cleveland	34				
Detroit	52				
New York	48	31	41	31	23
New York, Law		23	57	57	
Pittsburgh	111				
Philadelphia	36	54	52		
Providence					

The capacity of the cord and plug switches is represented in table 11, and shows the cord board to be rapidly supplanting the plug.

TABLE NO. 11.

CAPACITY OF SWITCHES IN WIRES.

	Cord.	Plug.
1885	46,985	15,110
1884	38,070	23,418
1883	21,432	12,763
1882	16,799	12,755
1881	8,893	11,904

Table No. 12, giving the number of switch-boards in use, of the several manufacturers, does not fairly represent the actual facts, and while it may be printed, it is hardly necessary to read it now.

TABLE NO. 12.

SWITCH-BOARDS IN USE.

	1885.		1884.	
	No.	Capacity.	No.	Capacity.
Western Electric, Multiple	9	13,000	5	11,900
Western Electric, Straight	60	13,595	69	13,425
Gilliland	19	4,405	35	7,160
Williams	32	3,585	55	4,523
Law Tel. and Tel. Co., Multiple	2	3,900	.....	.....
Law Tel. and Tel. Co., Straight	8	3,250	10	6,750
Utica Fire Alarm	4	1,475	5	1,625
So. Bell Tel. and Tel. Co	4	1,160	6	1,375
C. E. Jones & Bro	11	3,940	6	1,223
Nebraska Telephone Co	1	1,000	1	1,000
Bergman & Co	7	4,600	1	4,200
Davis & Watts	2	200	3	200
Post & Co	4	140	3	100
Watson	2	200	2	100
R. I. Elect. Co	1	200	.....	.....
Philadelphia Co	6	415	.....	.....
Detroit Elect. Co	2	1,225	1	1,450

The last table covers line and instrument trouble. Heretofore no place has been made in the statistical report for this important part of the Exchange work, and I thought that the figures at hand would be sufficient justification for my giving them some prominence. I have taken fifteen of the largest Exchanges which no doubt furnish quite accurate returns. To put the figures in good shape for readily remembering, I have calculated the frequency of trouble on each telephone, and have arranged the offices so that the one having the most trouble per telephone is at the top of the list.

TABLE NO. 13.

LINE AND INSTRUMENT TROUBLE.

City.	Trouble.		Total. Trouble.	Every Day.
	Inst	Line.		
Cincinnati	35	71	106	24
Philadelphia	36	58	94	24
New York	108	91	199	26
Pittsburgh	31	28	59	28
Chicago	42	66	108	33
Albany	20	15	35	33
Baltimore	23	24	47	35
Boston	17	30	47	36
Milwaukee	20	17	37	37
Providence	40	5	45	48
Washington	13	10	23	49
Detroit	20	20	40	49
St. Louis	16	14	30	51
Buffalo	15	10	25	61
Brooklyn	17	21	38	62
Fifteen Exchanges	491	512	1,003	31

The fifteen exchanges, representing 31,945 subscribers, have 491 instrument troubles daily. These telephones call six times, and are called as many, making the average use twelve times daily. Four hundred and ninety-one troubles in 31,495 telephones is one case on each, every sixty-five days. Calculating the daily use on the basis of the information furnished in another table, each telephone therefore is used 780 times before becoming defective. This is not a poor showing for instruments as they go, and one would readily conclude that the defect was occasioned by heavy use. Now consider the figures furnished by the small exchanges of 10,000 population or less, where we know the service demanded is comparatively light. Forty-four exchanges, having twenty-five to two hundred subscribers each, and in all 3,218 subscribers, report fifty-nine line and sixty-three instrument troubles daily, or a total of one hundred and twenty-two. This is one case every twenty-six days against one case every thirty-one days in the large exchanges. The sixty-three cases of instrument trouble is one in fifty-one days to each, as against one in sixty-five days for the large exchanges. These telephones are used on an average of seven times daily, so that they are good for 357 connections, as against 780 before becoming defective. The figures from the small exchanges are taken from the report of the last Convention. Only exchanges reporting a definite number of cases of trouble are included in the forty-four. While the figures savor somewhat of guesswork, they may be, on the whole, representative of the facts, and can be used for this purpose. They indicate clearly that in the nature of the construction of the several instruments, making up the subscribers' outfit, there is bound to be a case of trouble about once in two months, without direct reference to the service performed. If we can depend upon the accuracy of the reports forming the

basis for these calculations, the conclusions to be drawn are: First—several manufacturers should redouble their efforts to furnish instruments b able to resist the action of lightning, dampness, heat, dust, dirt and the influences of an injurious character that abound in different localities. Seco When we consider our maintenance account we are not jutsified in figu residence and country rates low, because our machinery will get out of o less frequently than the business telephones in the city. I do not unders that "Inspection" has been included by any of the exchanges under the h ing of "Instrument trouble." It has not been in the Chicago report, wh if we were to add Inspection to the other two items, it would give us a run each subscriber every twenty-four days. In connection with this part of work, I will add Table 14, giving the salaries of outside men.

TABLE 14.

SALARIES OF LINEMEN AND INSTRUMENT MEN.

Fifteen Exchanges.—153 Men.	Linemen.	Instrument Men.	Combinatio
Highest	2.30	2.17	2.46
Lowest	1.60	1.45	1.97
Average	2.00	1.79	2.21

Without desiring to unnecessarily lengthen this already too long drawn-o report, I want to remind you of the very appropriate remarks concerning insu lation and conductivity in the last report of the Statistical Committee. I thin that we are rapidly disabusing our minds of the false theory that bad insulatio and poor conductivity do not impair the working of the telephone; and I wan to suggest a more universal adoption of the galvanometer for the purpose o discovering defects in lines and instruments, that are alike hurtful to city an toll-line service. In attempting this piece of missionary work I am backed b some cold facts, and you will pardon me if they are not from the several ex changes but from Chicago alone. We have been measuring every wire in all o our offices, and have about half of them done. We found 112 defective, and re moved 100, 111 ohms resistance, or an equivalent to the resistance of 3.128 miles of No. 12 iron wire. The majority of cases of trouble were in line con nections, probably made in the winter, the repairer doing his work carelessly and hurriedly to get out of the cold. Many cases were at the ground connec tion or in the instruments. We aim to solder all connections, and notwithstand ing our strict enforcement of the rule we cannot avoid these troubles, nor can any exchange. Some of the lines of the 112 had been repeatedly complained of by the subscriber, and as many times tested the old-fashioned way and found O. K. The galvanometer quickly discovered the trouble for us. As all ex changes must be afflicted in this respect as we are, we are glad if our experi ence can help them.

Respectfully submitted,

B. E. SUNNY.

MR. METZGER—I move that the paper of Mr. Sunny be accepted and spread upon the records of this Association.

MR. CARSON—I second the motion, and would also move that the thanks of the Association be given to Mr. Sunny for his paper, for there has been a great amount of labor expended in the preparation of it.

The motions were both adopted unanimously.

THE PRESIDENT—I am requested to extend to all the members an invitation from the Providence Telephone Company for you to visit their Exchange.

We have now about three-quarters of an hour before our regular recess, and, I think, in that time we can hear the paper prepared by Mr. Storke upon the subject of "Legislation."

MR. DURANT—In connection with the paper read by Mr. Sunny, I desire to say that you will find on the wall a statistical diagram, representing the business of the Bell Telephone Company, of St. Louis, for 1884. It relates only to its exchange business, and represents the itemized amount per annum, including the total cost. This diagram is not published; but to any of the larger exchanges who desire to see the figures, and who would be willing to exchange exhibits, I should be very glad to show the paper.

The figures were submitted to General Sherwin, and correspond with our annual statement. In order to make it a little more interesting, I have shown the seven offices, comprising the two exchanges of the company (explains the diagram at length). I don't know any work that will be more gratifying or satisfactory to those in charge of large exchanges than to make a similar analysis, and satisfy themselves as to the cost of operating per station, per annum, for each item. I have brought this here to-day in the hope of provoking a little work in that direction for the next meeting.

THE PRESIDENT—The Chair would remark, in this connection, that, while Secretary, and, particularly, before that, while working with a committee in the preparation of exchange statistics, he made repeated and persistent efforts to get

itemized details and statistics of the cost of operating per station, the cost of batteries, maintenance, and such items as that which are of vital interest to all of us; but, I fancy, at that time the state of accounts and the multifarious duties which weighed upon the managers, prevented their returning such statistics, however willing they might have been. I think that the appointment of a regular Secretary, who can give time to the preparation and collection of such things, will result in our being able, another year, to furnish accurate cost statistics, made out in detail, from the various exchanges, which will be of almost inestimable value to us in determining the results of our own work. There is nothing like having some other man's mark to jump to, to test your own powers.

We will now listen to Mr. Storke's paper.

Mr. H. L. Storke, of New York, then read the paper upon "Legislation," as follows:

LEGISLATION.

In response to the circular asking for information on legislative matters, but partial returns have been received. These, however, cover the most important of the many attempts made to control or restrict the operations of our business. Such efforts may be divided into five classes:

1. Laws regulating the connection with telegraph companies.
2. Taxation of telephone companies.
3. Laws putting telephone companies under the control of a Commission, similar to the existing Railroad Commissions.
4. Underground legislation.
5. Laws fixing the rate to be charged for telephone service.

I. Agitation under the first class, or what may be called anti-discrimination laws, is fostered by telegraph companies working in opposition to the Western Union Telegraph Company, and is designed to give them the same facilities for the receipt and delivery of messages by telephone now enjoyed by that company. The following is a copy of the act passed by the Massachusetts Legislature last winter:

An Act to prevent discrimination by Telephone Companies.

SECTION 1. Any person or corporation owning, controlling or operating a telephone exchange or service in this Commonwealth shall, on application of any telegraph company, furnish the telegraph company so applying with the use of a telephone or telephones, and telephone service, and connection with their respective exchanges, the subscribers thereto, and telephone service without discrimination between telegraph companies as to such connection, service or instruments furnished or charges therefor, for the same class of service.

SEC. 2. Any person or corporation owning, controlling or operating a telephone exchange or service in this Commonwealth shall, on application of any individual or corporation and the tender of the charges or rental sum usual or customary for the class of service required, without discrimination for the same class of service rendered, furnish such individual or corporation so applying with the use of a telephone and telephone service and connection with their respective exchanges and the subscribers thereto: Provided, that the individual or corporation applying will secure the rights necessary to make the connections applied for, and pay to the telephone company in advance a sufficient sum to cover the actual cost of the extension, if said extension is beyond one mile from any main exchange circuit of the said telephone company applied to.

SEC. 3. Any court in the Commonwealth having equity jurisdiction shall, upon petition of any party in interest, enforce the provisions of this act by any suitable process or decree in equity.

II. The question of taxation is assuming serious importance, in view of the extension of our toll lines over all sections of the country, bringing our property in reach of local boards of assessors everywhere.

In many of the States, and particularly in the South, license fees are charged in addition to the regular property tax. In New York, our lines are assessed as real estate, subject to taxes for State, municipal and local purposes. Unchecked assessment, under which we might otherwise suffer, is regulated to some extent by the following law permitting the companies to make a sworn statement of the value of their lines.

An Act to provide for Fixing the Manner of Assessing Certain Real Estate of Telegraph Companies.

PASSED July 1, 1881.

The People of the State of New York, Represented in Senate and Assembly, do enact as follows:

SECTION 1. It shall be the duty of the several telegraph companies owning a line or lines of telegraph within the State, to return, under the oath of its president, or secretary, or treasurer, on or before the first day of May in each year (or at least twenty days days before the time required by law for the delivery of the assessment rolls by the assesors), to the Comptroller of the State, and also to the Treasurer of each county in which any portion of the lines of such company is located (in the city of New York, such return to be made to the commissioners of taxes and assessments thereof), a statement showing the total length of such lines within each county, with the cost of construction, including all equipments, or *what* would *be the cost* of *reconstruction* thereof *on the* first day of *January* preceding the date *of such return*, and it shall be the *duty of the assessors* in each assessment district in which such property is located, to insert in the assessment books thereof, for the purpose of taxation as the value of such property within said district, such proportion of the cost of construction or reconstruction as the length of the lines of such company within such district bears to the aggregate length of all the lines of such company within the county. The treasurer of such county shall notify all town and city clerks by sending them a copy of the sworn statement received by him from any telegraph company as herein provided.

A recent decision by Judge Westbrook, setting aside an excessive assessment on the property of the Delaware and Hudson Canal Company, is likely to prove a warning to local officials who seek to compel corporation property to carry more than its fair share of the public burdens.

In addition to the above, we are subject to a capitalization tax of one and one half mills. If the stock divides, or earns 6 per cent., it must be returned at par;

if less, a sworn statement of its estimated value must be made, based on latest sales.

A tax on gross incomes is also imposed at the rate of five-tenths of one per cent.

In the Illinois Legislature a bill was introduced authorizing incorporated cities, towns and villages to exact a license fee from telegraph and telephone companies, and to impose fines and penalties for disobedience, which failed to become a law.

There was also an attempt made to include telephones in the bill taxing telegraph companies three per cent. of their gross receipts, but the clause affecting telephone companies was dropped.

In the Nebraska Legislature bills for special assessment of telephone property, and to compel telephone companies to remove contract restrictions prohibiting outsiders from using subscribers' instruments, died a natural death.

III. *Telephone Commissions*—The following is the text of a bill introduced in the Massachusetts Legislature. This was submitted as a minority report of the committee to which it was referred, and defeated by a majority of four or five to one:

An Act Placing Telephone Companies under State Supervision and Inspection.

SECTION 1. In addition to the duties now imposed by law upon the Board of Railroad Commissioners, it shall have the general supervision of all public telephone lines and district or divisional exchanges, and shall examine the same, and the Commissioners shall keep themselves informed as to the manner in which they are operated with reference to the accommodation of the public, and as to the compliance of the several corporations owning and operating such telephone lines and exchanges with their charters and the laws of the Commonwealth; and the Board may from time to time establish the rates of rentals to be charged to telephone subscribers in district or divisional exchanges for telephones or transmitters, and the appliances and attachments connected therewith leased to them, and may from time to time establish tolls and rates for all kinds of telephone service.

SEC. 2. The Board, whenever in its judgment any telephone company has violated a law, or neglects in any respect to comply with the terms of the act by which it was created, or with the provisions of any law of the Commonwealth, shall give notice thereof in writing to such corporation; and, if the violation or neglect is continued after such notice, shall forthwith present the facts to the Attorney-General, who shall take such proceedings thereon as he may deem expedient.

SEC. 3. Every such corporation shall, at all times, on request, furnish to the Board any information required by it concerning the condition, management and operation of the telephone lines and district, or divisional exchanges of such corporation, and particularly copies of all contracts and agreements with other telephone companies to which it is a party, and also a statement of all rates charged to telephone subscribers for the use of telephones or transmitters, and appliances and attachments connected therewith, and for extra territorial communications or messages, and also a statement of all rates charged for public telephonic service within the Commonwealth, and within and without the Commonwealth, in such form as the Board may require.

SEC. 4. All expenses of the Board incurred under the provisions of this act, including the salaries of such clerks or accountants as it may be necessary to employ to give the same effect, including also any additional salaries to the Commissioners which may be hereafter fixed upon, shall be borne by the several corporations engaged in the business of making, owning, selling, using and

licensing others to use electric speaking telephones and other apparatus and appliances connected therewith, and of maintaining and operating public telephone lines and district or divisional exchanges, according to their gross earnings received in the transaction of such business, and shall be apportioned by the tax commissioners, who, on or before the first day of July in each year, shall assess upon each of said corporations its just proportion of such expenses, in proportion to its said earnings for the year next preceding that in which the assessment is made; and such assessments shall be collected in the manner provided by law for the collection of taxes upon corporations.

SEC. 5. The Board shall make an annual report of its doings to the general court, including such statements, facts and explanations as will disclose the actual working of the public telephonic system in its bearings upon the business and prosperity of the Commonwealth, and such suggestions as to the condition, affairs or conduct of any telephone corporation, as may seem to it appropriate.

IV. *Underground Legislation.*—This subject is looming up as one of the chief difficulties in the way of our business in the larger cities, and one that must be met. The subject has been agitated to such an extent that it is to be assumed that there is not likely to be a change in the public clamor for the suppression of the overhead systems. The city of Chicago, by an ordinance passed some years ago, with which you are familiar, prohibited the further stringing of aerial lines, and this has been followed by similar legislation or attempts at legislation in many of the States. The following is an extract from a letter received from Mr. Fay giving the existing situation at Chicago:

* * * * * * *

"There is no change in the situation of our city affairs. The underground ordinances passed by the common council are still in force, and it is becoming gradually more difficult for us to live under them. We this year expect to put down underground cables at three of our principal exchanges, extending in all directions an average of one-third of a mile from the central office. The wires centreing in these exchanges are all upon poles, and these heavy pole lines have been a constant menace to us for fear of sleet storms. The underground works proposed will do away with all the masses of wires in excess of fifty for that distance from the central office, and another year we propose to extend and connect together these cables if the work proves satisfactory. I think it is doubtful whether we ever rebuild any of the heavy pole lines, which are now beginning to show the effects of age, but will put them into underground cables with aerial extensions, both for the purpose of complying with the law as far as possible, and because we believe it to be economy."

In New York what is known as the Daly Underground Bill was passed a year ago, applying to the cities of New York and Brooklyn. A copy is to be found in Mr. Eckert's report printed in the Proceedings of 1884, page 33, to which reference can be had. Last winter a law appointing commissioners to act thereunder was passed.

In Pennsylvania strenuous efforts were made to secure the enactment of laws compelling the companies to put their lines in sub-ways. I am indebted to Mr. Metzger, of the Pittsburgh Company, for the following:

* * * * * * *

"The first bill was presented in the House, and was an exact *fac simile*, as I understand, of the bill before the New York Legislature, commonly known as the Daly Bill. This bill provided that if the wires were not underground by the 1st of January, 1886, all the officers, employees, etc., were liable to be convicted and sent to the penitentiary for a period not exceeding two years, and subject to a fine not exceeding $500, if the companies failed to put their wires under

ground. The bill was so absurd that the committee reported it negatively. Certain members of the Legislature, being interested in underground schemes, forced the bill on the calendar notwithstanding the report of the committee. In the meantime a similar bill was introduced in the Senate. This bill was referred to the Judiciary Committee. The arguments of the various representatives of the telegraph and telephone companies took up considerable time; in fact so much that the bill was the last or among the last on the calendar. The bill was amended by this committee, confining the operations of the bill to the cities of the first and second class, viz., Philadelphia and Pittsburgh, and in substance referred the matter to the city councils, with the provision that within six months after the ordinance had been passed by the city councils, all wire should be underground, and in case of refusal on the part of the companies to do so, it authorized the local government to take them down. This bill passed in the Senate and came up in the House on the last night of the session. About four o'clock in the morning, after a large number of bills that preceded it on the calendar had been dropped therefrom, a direct vote was had upon the motion to put the bill upon the second reading and was defeated by a vote of 88 to 23.

"I can assure you that the telegraph company and the telephone companies left no stone unturned to accomplish this result. We will now have peace for two years, as our Legislature does not meet before that time. The arguments of the various attorneys were very complete, and if you can get the pamphlets, which I think you can from Mr. Ker, you will find it very entertaining and full of material for your report, as the arguments were thorough and exhaustive. I herewith name the attorneys whose speeches were printed: General Swayne, of the Western Union; John M. Reed, of Philadelphia; and M. L. Olmstead, of Harrisburgh, attorneys for the Western Union, and John Dalzell, of Pittsburgh, for the Central District and Printing Telegraph Company."

The pamphlets referred to I have filed with the Secretary, and also arguments made by Mr. Henry Bently, Willard R. Brown and George D'Infreville, for the information of the Convention.

In New Jersey bills compelling telephone companies to go underground, allowing them to bury the wires in the cities of the State and granting telephone companies rights in the condemnation of property, were alike defeated.

V. *Regulation of Rates.*—The consideration of this portion of our report begins, and I trust will end with what is known as the Indiana Bill. The following is its text:

The following law was passed by the Indiana Legislature:

HOUSE BILL 44.

SECTION 1. Be it enacted by the General Assembly of the State of Indiana, that no individual, company or corporation now or hereafter, owning, controlling or operating any telephone line in operation in this State shall be allowed to charge, collect or receive as rental for the use of such telephones a sum exceeding $3 per month where one telephone only is rented by one individual company or corporation. Where two or more telephones are rented by one individual company or corporation, the rental per month for each telephone so rented shall not exceed $2.50 per month.

SEC. 2. Where any two cities or villages are connected by wire operated or owned by any individual company or corporation, the price for the use of any telephone for the purpose of conversation between such cities and villages shall not exceed fifteen cents for the first five minutes, and for each additional five minutes no sum exceeding five cents shall be charged, collected or received.

SEC. 3. Any owner, operator, agent or other person who shall charge, collect or receive for the use of any telephone any sum in excess of the rates fixed by this act, shall be deemed guilty of a public offence, and on conviction shall be fined in any sum not exceeeding $25.

(Passed April 16, 1885.)

Essentially the same bill was introduced in the Massachussetts Legislature and defeated by an overwhelming vote. In New York, Illinois and other States a vote was not reached, but should the Indiana bill be sustained by the courts (of which I am advised there is little fear), the business will be seriously crippled and in many places the use of the telephone absolutely prohibited.

The following letter from Superintendent Beach of the Central Union Telephone Company gives a clear statement of the situation in Indiana at the present time.

* * * * * *

"The accounts published in the *Electrical Review*, in reference to Indiana matters, are substantially correct. The company under advice of its counsel gave notice terminating old contracts in the State of Indiana, June 30th, and at the proper time undertook to substitute a new form of contract (pink copy enclosed), separating the rental of the telephones from our charges for switching and other exchange service. In order that the work of substituting new contracts might be done simultaneously and as quickly as possible, all superintendents of the company were temporarily concentrated in that State. We experienced no difficulty to speak of outside of Indianapolis, but at the latter point the subject was agitated, a meeting of subscribers called, and a combination formed for the avowed purpose of forcing the Central Union Company to submit at once to the law as the strikers saw fit to interpret it, and for this purpose a managing committee was appointed and an agreement drawn up and signed by over 500 subscribers, not to execute the new contract, nor to pay the company more than what they claimed to be the statutory rate for telephone service. The company declined absolutely to accept less than its established rates heretofore existing for telephones and service, but voluntarily offered to endorse upon each contract its agreement to refund any excess of charges over and above what the court of last resort should decide to be legal. This was declined by their committee, and upon the issue we began removing telephones. About 250 telephones had been removed, when their committee sought to reopen negotiations, which resulted in our agreeing to substitute for the striking subscribers our old form of contract (copy enclosed), with an endorsement on the back, which should be signed by the subscriber and the telephone company in each case, and which makes it the same practically as the 'pink contract.' It was admitted by the committee that such was the case; but that such a prejudice had been created against the 'pink contract,' that it would be difficult for them to justify their action in recommending the striking subscribers to accept it. This we interpreted to mean a desire on their part to let themselves down easy. A joint statement to the public was accordingly drawn up and published, and the striking subscribers at once signed contracts, and nearly all the telephones which were taken out were reinstated. In the operation we have only lost about 300 subscribers throughout the State. Our weekly reports indicate that these are being regained rapidly. A number of suits have been made up and brought to test the constitutionality of the law, its proper interpretation and other points involved. These I understand will come up in September, and it is hoped that a decision by the Supreme Court of Indiana may be reached this fall upon all the points involved. Our case is in good hands, and our counsel feel confident of success. I will add that our relations with Indiana subscribers, and the public throughout that State, are of the most friendly character, and during the difficulty referred to it was a common expression among the striking subscribers, that they had no complaint whatever to make as to the service, and that the telephone was well worth what it cost them, but that they were fighting for what they felt they were legally entitled to."

H. L. STORKE.

MR. STORKE—I will add that I have requested Mr. Sargent and Mr. Eckert to make some statements in regard to

their operations under the so-called "Commissioners'" bill in New York.

THE PRESIDENT—Are there any remarks upon the paper of Mr. Storke?

MR. KER—There is one point in the report that ought to be noticed. District Attorney Grimes' amended bill, which was accepted and passed by the Senate, gave six months' limit for the burying of wires, and the report states that the wires to be buried were *all* the wires. The bill only provided for one street if my memory does not deceive me.

MR. METZGER—You are mistaken. We tried to get only a certain proportion of the wires put down every year. That was rejected entirely. The bill then went on to say that the councils should direct the wires to be put down within six months.

MR. KER—So far as my memory goes, as Mr. Grimes read the bill, it was as I have stated it.

MR. METZGER—That was simply a speech of Mr. Grimes. That was not the bill as it came out from the Judiciary Committee. He submitted that bill, and it was altered in the Judiciary Committee.

MR. DURANT—From the little experience I had in our legislature last winter fighting adverse legislation, I would suggest, in a general way, that attempts to amend a vicious bill are very unwise. It is better to attempt simply the defeat of any bill of that character. We in Missouri had the same experience as did our Pennsylvania friends in their legislature, and still at the last hour the bill was defeated. I don't know as any fixed rule can be given for attacking such legislation or defending yourselves from it. Nor can I explain how we arrived at the happy result at Jefferson City. But it was a great relief at the last hour of the session to telegraph our people that the obnoxious bill was defeated. I think that the most effective way of working is to remain at the Capitol, cultivate the members a little, be frank with them, explain the hardships of objectionable bills, and you will generally find some rather energetic fellows pushing

bills of this character; if possible meet them in a friendly way and explain to them the hardships. That was our method, and we relied upon that wholly. Of course there are some men who want to be paid for imaginary services. To such we simply said, "We have not a dollar for you." There were three bills introduced regulating rates and fixing rates in cities of the first and second class. I think they all died in committee. We paid very little attention to them. But two of the committees to whom they were referred—at least the chairman of those committees—reported that they were oppressive and recommended that they do not pass. They seem to have been dropped quietly from the calendar. But the "underground" bills were pushed; there were two, and the first bill was re-committed to the committee in the House, and I don't remember what became of it. But a second bill was introduced in the House, and, in order to strengthen that, simultaneously another one was introduced into the Senate. The one in the House was passed, 106 ayes to 1 no, came up in the Senate, and was defeated almost in the last hour of the session.

Since I have been here I have read in a little pamphlet a report of a referee in the case of "City of Philadelphia against the Western Union Telegraph Company, and the Bell Telephone Company," in which the City attempts to exact a license fee, under the exercise of its police powers, and in which case the referee reports adversely, I believe, on the ground that the fee attempted to be exacted was unreasonable. In St. Louis the City have legislative power to impose a license upon several of the professions and the general commercial business, and in the list of companies which they are empowered to tax are telegraph companies. As we were organized under the telephone and telegraph statute, our counsel advised us that he believed the City had the power to impose that license tax upon us, and we paid it. It is fixed at 2½ per cent. of the gross receipts of the telephone business within the city of St. Louis, up to 1890, and 5 per cent. thereafter. We pay that, and in addition to that we pay a tax upon personal property.

THE PRESIDENT—Mr. Eckert has a short report upon the operation of the commission appointed by the legislature of New York to carry into effect the underground law. We should be pleased to hear from him upon that subject.

MR. ECKERT—We have three underground systems—the Brooks, the Western Electrical Company's and the Edison.

At our 39th street Exchange we have underground the Patterson cables made by the Western Electric Manufacturing Company. Each cable contains from 50 to 100 conductors. The longest length of cable in use is 1,939 feet, and the shortest 1,300 feet. Of these cables we have running from this exchange, through 39th street to the corner of 7th avenue, five cables, four of which are 100 conductors and one 50 conductors; also three cables running from same exchange through 6th avenue to the corner of 42d street of 100 conductors each, and one cable of 100 conductors from this exchange to the corner of 45th street and 6th avenue. The total wire mileage of underground wires in the Patterson cables is 220 miles; the total number of conductors 868, of which 629 are at present in use. The cables are placed in wooden conduits three feet below the surface of the street, and are not arranged so that they can be drawn out of the conduits. Insulation between conductors is from 1 to 500 megohms per mile. Size of conductor, No. 18 American gauge.

At our 21st street Exchange we are using the Edison system of underground wires made by the Electrical Tube Company. The wire mileage in this system is 194 miles; number of conductors 981, of which 561 are in use. The longest single length of cable 1,694 feet, and the shortest 797 feet. There are from 100 to 271 conductors in each cable. Each wire in the cable is covered with a cotton braiding with an insulating compound. All the conductors are bunched together and placed in iron pipes, and an insulation of asphaltum is forced into the pipes and entirely surrounds the cable. The sections of iron pipe are each 30 feet in length, two sections being connected together before the cable is placed underground. The pipes are laid four feet under the

surface, being painted with tar, and a board laid on top to protect them. The test for insulation 250,000 to 300,00 ohms per mile between conductors.

At our Spring street exchange we are using the Brooks' underground system made by the Electrical Construction and Maintenance Company, of Philadelphia. In this system the wires leave the exchange in two 4-inch pipes containing 380 conductors each, and are carried on through pipes of various sizes down to 2½ inches in diameter to the various points where the wires are distributed on the poles. The total number of miles of wire laid underground by the Brooks' system is 200; the total number of conductors is 760, of which 501 are in use. The longest single length of cable is 2,448 feet, and the shortest 365 feet. There is a cotton covering around each conductor; the whole number of conductors contained in each pipe being made into a cable. The pipes are laid in the street three feet underground, and the cable drawn in after the pipes are down, and then the pipes filled with oil. The pipes are laid in a wooden conduit, and then pitch poured over until the conduit is filled. Insulation test from 14 to 30 megohms per mile between conductors.

The three systems are working satisfactorily. The grand total of underground wire mileage is 614 miles.

MR. SARGENT—Have the commissioners undertaken to enforce the law in any oppressive way.

MR. ECKERT—No, we have just made a report to them, and we are waiting to hear from them.

THE PRESIDENT—I would say that this afternoon there will be read the following papers: One upon the "Underground Problem," by Mr. W. R. Patterson, of the Western Electric Company; one entitled "Observations on the use of Cables in Cities," by C. N. Fay, with discussions upon both.

MR. LOCKWOOD—I am aware that it is almost time to adjourn this session, and therefore I will endeavor to make what remarks I have to offer brief and germane to the subject. One of the chief lessons that we have to learn from

this able report is the necessity of united action on the part of members of this Association. It is in fact one of the chief functions of the Association that this united action should be obtained; that we should bring all our force to bear upon the various adverse influences which are directed against us. It is quite certain that if, in any case of adverse or absurd attempted legislation, we should use all the influences at our disposal, all the weight of this Association, instead of perhaps the combined weight of one or two companies, that that weight, aided by co-operation from the American Bell Telephone Company, would exert a powerful influence in defeating such legislation as should come up, whether it be enforced underground conductors, enforced regulation of rates, or whether it be illegitimate taxation. I think the regulation of rates is, perhaps, the most obnoxious class of legislation which we have suffered from locally. Much of it has not succeeded so far; but enough of it has succeeded to make it quite probable that we shall have more of it in a very short time. One way of grappling with this problem, it seems to me, and I am quite sure that others have also seen it, is that we should endeavor to form everywhere a public opinion to discountenance such acts. Another thing is, that we should endeavor to teach our local managers what to say to people when complaints are made of the universal extortion of the telephone companies. If I remember right a commission was appointed by the Government of the State of Ohio to inquire all about telephones, why the extortionate rates were charged, and as to how far they were extortionate; and the report of that commission generally, as I remember, was directed against the American Bell Telephone Company, as being the original cause, and the only present cause of the exaction of the present rates. The statement was made that the sub-companies were charged $10 per annum for each telephone and transmitter in use, making $20 for each subscriber; and the commissioners were led to understand that if it was not for that rental all would be very serene, and no subscriber would be charged more than $20 or $25 per year, and there would be

no complaints about expensive charges. Now, we should pull together in these matters. I think local managers should be instructed what to say, that every subscriber has both a hearing and speaking telephone, both of which cost money, and that the cost of obtaining the power of speaking through immense distances is no trifling consideration. It was a great discovery, and has had to be paid for correspondingly by the parties who now control the monopoly; that it is no small thing to defend that discovery; that litigation beyond anything ever known heretofore, in the history of inventions, has been necessary in regard to the patents that have been purchased; that millions of money have been spent to maintain the rights to the patents upon the telephone; that hundreds of other patents have had to be purchased, to buttress that patent up and to further improve telephonic communication. It is not only the speaking telephone itself, it is the hundreds of signaling instruments, the hundreds of means of suppressing numberless induction disturbances and other costly appliances. They should also be instructed to show that a line costs money and is in use for a very small portion only of every day, and that while it is not in use it is idle and bringing in no income to the telephone company; that a line when properly built, out of the very best materials, is at the mercy of winds and weather; that it will not last very long, even if there were no winds and weather; that a telephone box is an expensive matter, cannot be expected to last more than three or four years, and, further than that, the subscriber does not pay for his box, his telephone and his line, simply, but in a greater proportion for the *service* that he gets, and when he pays for heavy service and gets good service he should be satisfied to pay for it, as for anything else. They should also be instructed to point out that it is a business consideration. A man is not compelled to use the telephone, and naturally will not pay for its use unless he gets value received. If he goes to a dry goods store and wants to buy a silk dress for his wife and thinks the price too great, he don't go to the legislature to make all the dry goods dealers in Boston reduce the price of silk dresses. He says that he cannot

afford to pay so much, and that his wife must be satisfied without a silk dress. These considerations should be pointed out and every local manager should be competent to explain these things, and show how reasonable it is that a reasonable rate should be charged for reasonable services.

In conclusion, I have great pleasure in moving that a vote of thanks be passed to our Treasurer, H. L. Storke, Esq., for his able, effective and compendious paper, and in also moving that the paper be spread upon the minutes of the Association.

The foregoing motions were seconded by Mr. Durant, and were unanimously adopted.

THE PRESIDENT—I would like to add a word to what Mr. Lockwood has said in regard to the work of this Association in effecting legislation. It is true that we cannot do very much as an Association in this direction. We can as an Association, through the medium of our Secretary, furnish all the members of the Association with what information is necessary to guide them in their legislation at home. We have to deal with legislation, each of us, in our our own State. We find for the most part—I think almost every one will bear me out in that—that the bills attacking corporations are generally started by men who have an axe to grind. We find, as a rule, that our subscribers take no active measures to restrict our rates or interfere with our business. We find that our subscribers, generally, while they will grumble, as a matter of course, against any monoply, will, when it comes to practice, pay their telephone bills very cheerfully. We don't find that they organize among themselves and employ agents to go to legislatures to start antagonistic bills, but we find that these bills as a rule are the gratuitous work of men, who, as I say, have an axe to grind. They are generally men from large cities. Oftentimes they are men selected from the very worst class of our population, and frequently they expect to be bought off. In other cases they expect to gain popularity by attacks upon a corporation, and in general they are not men who can well be reached by open and fair argument. Fortunate-

ly the great majority of legislators are honest, and a fair argument, properly presented in a gentlemanly way, will usually convince the average legislator sufficiently to prevent his passing very extortionate, very obnoxious or very odious bills. But there are a great many legislators who will dally long upon the question whether they will allow a corporation to make an honest profit, aye to make the same profit as a retail merchant would make in the course of his business. A great many of them say, "You are a corporation. You are the creature of the State. You have valuable franchises. You ought not to expect to do anything for profit, and you should be satisfied not to make anything, to do business for the fun of it, at most to make six per cent. on your investment." Taking business as a whole, few of us are realizing more than six per cent. upon capitalization, taking it throughout the country. The most potent argument, it seems to me, that we can bring to bear to protect ourselves from extortionate taxation, is the publication of our receipts and operating expenses; in other words, that our business should be in such shape, that for the protection of our own stockholders, and the information of the general public, we can publish our reports at frequent intervals.

Whenever we do that, it will be a powerful weapon against oppressive tax bills, because honest legislators can see that we are not monopolies, who are (as it is usually phrased) "robbing the people." The example of one State is a powerful factor in the action of other States and in the decisions of other States. We find that our legislators in Illinois are looking to what is being done in Indiana, and in Indiana they are looking to what is being done in Ohio. In fact, we found last year that a trio of enterprising gentlemen introduced the same bill into the legislatures of Indiana, Illinois and Ohio, thinking that their grip upon telephone companies would be all the more secure. The legislatures of different States differ very much in character. In some they are honest and intelligent; in others they are very far below that grade. But still the action of the honest legislature affects the action of the dishonest legislature.

It seems to me of the greatest importance that in those States where the average of legislative intelligence is high, that the members of this Association should make special efforts to secure honest legislation.

MR. METZGER—What method would you suggest by which we could accomplish such a desirable result as honest legislation? Should we become politicians?

THE PRESIDENT—Only the usual methods, that is, the employment of people to represent you at the State Capitol, you have got to employ suitable agents, and you have got to have your arguments ready to present in proper shape, and have that business attended to just as carefully as any other portion of your business.

MR. METZGER—The people in some States who attend to that special class of work are very high priced.

THE PRESIDENT—That makes no difference. It is one of the expenses of the business that will have to be borne.

In conclusion, I would simply say this: General Barney has now become our Secretary. He will have an office centrally located, and will give a great deal of time and attention to these things. It was the programme of the gentlemen who suggested this appointment, that the various representatives of the corporations should keep him fully informed as to everything that transpires, and that he, in turn, should circulate that information among the members of the Association; that unanimity and consistency may prevail in the front which is presented in each State to the legislature, so that the action of a telephone company in one State may not be quoted against a company in another State. Are there any further remarks now, gentlemen? If not, it is the hour for adjournment.

MR. METZGER—I move that we adjourn.

THE PRESIDENT—One minute before that motion is put. I wish to announce that the Brown & Sharpe Manufacturing Company extend an invitation to the members of the Association to visit their works. Mr. White, of the Providence Telephone Company, will pilot any members who desire to make this visit.

A recess was then taken till 3 P. M.

AFTERNOON SESSION.

The Association re-assembled at 3 o'clock P. M., the President in the chair.

The President communicated to the Association an invitation from the Washburn & Moen Manufacturing Company for the members to visit and inspect the works of the Company at Worcester at such hour on Saturday as may be convenient.

On motion of Mr. Sargent, the thanks of the Association were given to Washburn & Moen for their invitation.

THE PRESIDENT—The next business in order is the paper on "The Underground Problem," by Mr. W. R. Patterson, of the Western Electric Company. We expect that this paper will be followed by a paper by myself, entitled "Observations on the use of Cables in Cities," and that later than that in the afternoon General Sherwin will give us some suggestions on "Accounts."

Mr Patterson then presented and read his paper, as follows:

THE UNDERGROUND PROBLEM.

There are two classes who do not admit the existence of "the underground problem," namely, the enthusiastic inventors and promoters of "systems," and the average State and city legislator. The two form a mutual admiration society of gentlemen of vast scientific attainments and disinterested philanthropists. One of the former will admit that it used to be a problem over which electricians had labored in vain; the subject was accidentally brought to his attention by a newspaper report of the delay to the firemen caused by a lot of wires. It immediately occurred to him that those wires might be put underground. He lays no claim to any electrical knowledge, but is only a man of marked practical common sense, unhampered by any scientific hair-splitting. Governed only by the practical common-sense requirements of the case, he devoted several hours to thinking on the subject, and the problem was solved. Not satisfied with its general solution, he subsequently went through a long course of mental experiment, thoroughly reduced it to paper, and had it patented. It now only awaits your adoption. The promoter of the Universal Electric, Signal, Telegraph, Telephone, Electric Light and Power Transmission, Underground Insulated Cable and Conduit Construction Company knows the system can only be an unqualified success. Isn't it patented? If that isn't enough, didn't the attorney tell the inventor that an examiner in the office overheard the Commissioner say to the Secretary of the Interior that there wasn't anything on the earth or the heavens above, or the waters under the earth, that in any way resembled this wonderful invention?

Some rainy day when the base ball game is postponed, the leading newspaper sends its scientific reporter to find out all about the subject. The reporter is a young man just out of a college, where he has learned all about the recession of Greek accents ; he laughs scornfully at the man who asks him how they make those little telephone wires hollow, and the next day furtively picks up a piece to examine, finds it solid, and thinks he may have been mistaken after all, and got a piece of telegraph wire ! This knowledge, backed by a vivid imagination, and all the information obtainable from the inventor, furnishes the basis of a long local article and of an editorial, in which is duly set forth the meanness, heartlessness and want of regard for the rights, property and lives of our citizens on the part of these grinding monopolies. The philanthropic legislator is impressed by all these things. He "don't take no stock in them scientific chaps ; they are all in the pay of some big monoply, and every-day hoss sense is good enough for him." He knows of no obstacle, mental, physical or moral, that money will not overcome, and here is a chance to get at these "grinding monopolies," help the struggling inventor, make business good, and get the vote of that man who is kicking about a telegraph pole in front of his house. So an ordinance is passed requiring all the wires to be placed underground within thirty days, and what is the use for us at this late day to talk about an underground problem ?

You, gentlemen, have all read the information furnished by such a reporter, have suffered under such a legislator, and been taught your business by such an inventor. It has been demonstrated to you beyond question that your wires will work better and for a longer distance, and that there can never, under any possibility, be any outlay for repairs or reconstruction in this underground system. If you have not already, it is probable that you soon will meet with a sufficiently enthusiastic promoter who will demonstrate mathematically that the junk value of your old wire and insulators, and the kindling wood value of your poles and fixtures will pay for an entire and absolutely perfect underground system. Yet in spite of all these demonstrations, and in spite of the assumed power of a city council to regulate not only the laws of trade, but the laws of nature, it is a fact that men, who are practically interested in the matter, still see difficulties in the way. These difficulties may be divided into three general classes : scientific, mechanical and financial. One man tells us there are no scientific difficulties in the way of underground telephony, and another tells us they are insuperable, and both are right. If it is only a question of talking across the street, there are none ; if it is a question of talking across the ocean or a continent, they are insuperable with our present knowledge. It would be very rash to claim they must always be so, but it will take something besides an act of the legislature, or an ordinance of the city council to overcome them. The scientific obstacles in the way of unlimited and universal underground telegraphy and telephony are retardation, escape and induction. These difficulties are common to underground wires for all uses, but are especially troublesome in telephone work. It is the subject which has received least attention from inventors of systems, and it seems entirely beyond the comprehension of most people that an underground wire, say from the Harlem River to Jersey City or South Brooklyn, may in some respects be an exact counterpart of an aerial line from New York to Buffalo or Pittsburgh.

The causes of retardation are well understood, and its laws well defined, both by mathematical reasoning and by actual experiments upon long submarine cables. Every text-book of electricity gives formulas for the speed of working cables, and in connection therewith the distance which a cable of any specifications can be worked at a given speed, which is the telephonic way of stating the case. If a telegraph cable will not work at the rate of forty words per minute, it may be perfectly feasible to work it at a speed of twenty, and it is only a question of providing a duplicate cable if the business requires forty to be sent. But the laws of acoustics fix the number of vibrations per second for any definite sound, so if a cable cannot carry the requisite number, that is an end of the matter. The distance which can be marked is shown to be a function of the resistance of the conductor and its electro-static capacity. In the present state of metallurgical science it is not to be expected that a better conductor than copper can be found. While chemists and others, principally others, can turn out new insulating compounds almost without number, they can all be grouped into a few generic classes, the properties of which are well understood. It is not to be expected that a material of lower inductive capacity than air can be discovered, or an insulator suitable for underground use, which even approximates the low capacity of air. We cannot make up the deficiency by increasing the thickness of the insulator indefinitely, because that has comparatively small effect. Besides these theoretical objections, there are practical difficulties in handling a large number of wires which necessarily limit the size of each, and finally there is a limit to the last, which precludes the use of metal and insulator in unlimited quantities per foot. The other factor, the resistance of a telephone circuit, has been generally, until of late, considered to be of little importance. Every one has talked through a wet string, or through a man's body, or in some such way shown that the current sent by the transmitter will overcome resistances, which would be a practical break in a telegraphic battery circuit. But we have seen that the resistance of the circuit is one of the elements which determine the speed of working, or the distance which can be worked at a given speed ; so it becomes a matter of the utmost importance that not only the resistance of the cable conductor shall be low, but that all other parts of the circuit, especially ground connections and splices, shall be of low resistance. With all these well-defined and unchallenged limitations there can be but one result—the length of wire which can be successfully worked must be limited.

If we had to provide for but one city the limitation might not be troublesome ; but there is a demand for commmunication between distant places. While the underground wires may work perfectly in one city, when a long aerial line is attached the conditions are entirely changed, and it will not improve matters any if there is an extensive underground circuit at the distant end. This question of the possibly required aggregate underground mileage in a thickly-settled country is the hardest part of the problem. This year it is only for cities of over 500,000 inhabitants, but how long will it be before cities of 100,000 inhabitants will follow suit, and villages of 1,000, seeing in underground wires a feature of metropolitanism that will cost them nothing, will before many years be asking for commissions and enactments.

The second difficulty we have referred to is the escape of the current. This escape is to be considered in three aspects—first, as so much direct loss ; second,

in its effects upon other conductors; and third, in its effects upon the medium through which it passes. In both the first two effects aerial lines share equally with underground, and there is nothing in either to limit or destroy the efficiency of underground wires. But in the third aspect—the effect of the escaping current when the medium through which it passes—underground wires are peculiarly liable to injury and destruction. In case of an aerial line, whatever current escapes and does not get upon other wires goes harmlessly to ground. In underground wires, wherever it goes, it first passes through the insulator. Electricity is a great promoter of chemical changes, and though the current passing through the insulator may be very small, almost inappreciable with ordinary instruments, yet when it is continued for an indefinite length of time the aggregate effect may be serious. For this reason a high initial insulation is the best guarantee of durability provided only the material exposed to the action of the elements has stood the test of time. The specific insulating quality of any material used for an insulator is so high, that unless this result is obtained it is conclusive evidence of some fault in manufacture, which may become serious. But the difficulties to be overcome in securing high insulation are of more practical interest to the manufacturer. In the matter of induction we have nothing essentially different from the troubles experienced on aerial lines. While the proximity of the conductors in cables would seem to offer the best conditions for the establishment of induced currents, the proximity of the earth to a great extent prevents their becoming troublesome. Metallic shields, wholly or partly surrounding the conductors, individually, or in groups, are a well-known device for preventing induction, and the use of a symmetrically placed return wire is an absolute cure for the trouble. But the remedy may be worse than the disease if too much is taken to cure a slight case, since the return wires increase the resistance of the circuit, and other things being equal, the nearer the ground the higher the inductive capacity, and induction is only exchanged for retardation. In case of very long cable lines, induction is a factor not to be neglected. We know only two ways of removing it, namely, by increasing the length of the wire and by increasing the inductive capacity. This is the problem, then, to be solved. Construct an underground system, the ultimate extent of which is an unknown quantity, so that neither induction nor retardation will render it useless.

After the mechanical work connected with the manufacture of the wire and its insulation is properly performed, there still remain mechanical difficulties to be overcome in laying the wires so as to secure the utmost possible durability, or even to insure any service at all. None of these mechanical obstacles are insuperable or offer as much difficulty as the electrical requirements which we have discussed; yet they are not to be neglected, as any want of forethought or care in handling and protecting the wires may destroy the best electrical work. Most of the mechanical difficulties experienced are of such varying character that only a careful study of the conditions existing in each place can overcome them. In general, the system which requires the least possible work to be performed in the street will escape much of the danger of injury. The number of impossible things that happen and the grand aggregate of all the little things that are done to the detriment of the work by an inquisitive crowd, the weather and the

total depravity of inanimate matter, would seem incredible to any one who had not experienced them. What is the best method of protecting underground wires from external injury is as easy to decide as the best way of protecting human life from loss by accident and violence. The ideal protection for underground wires would be a dry, light, roomy and well-ventilated subway. Such a one can be constructed with the utmost facility on paper. It would be found in a city built to order under one comprehensive plan, and before it is lived in, completely equipped for a hundred thousand or a million inhabitants, as the case might be, with no subsequent additions allowed. But we have to take cities as we find them, which, like Topsy, "have growed." With the existing systems, or more generally lack of systems of sewers, water, steam and gas pipes, street railways, and the general plan of streets and alleys, such a subway is impractical. We are reduced to two general methods of protection: one is to lay the wires or cables, and fill in around them with a mass of protecting material as asphalt or cement; the other is to draw the cables into a previously constructed conduit. Neither method is free from disadvantages when compared with the ideal subway, but the conduit plan seems to have less than the other, and to offer some advantages which are a fair return for the additional expense. In the choice of a method of protection all the local conditions are to be considered, and a plan which is successful in one place may be a failure in another.

The third class of objections we see are financial. It needs no argument to show that it will cost a great deal more to put all the wires of an exchange underground than to carry them on poles and house tops. Saying nothing about its theoretical advantages, air is by far the cheapest insulator known. The insuperable part of the financial difficulty is the proposed throwing away of a full equipment of lines which are in working condition and replacing them by an entirely new and more expensive system. To even overcome the difficulty due to the difference in cost the exchange must be made gradually—no faster than the existing lines need renewal.

After all this enumeration of the difficulties in the way of underground service, it may seem that we have left no useful field for it. But there is an extensive field open to such service, and we wish only to look at the matter fairly and impartially, recognising the existence of serious obstacles which cannot be dismissed with a word. We are convinced of the existence of certain limitations which have been enumerated. We are also convinced that within these limitations there are no reasonable doubts of the perfect success of underground service, as far as any electric troubles are concerned; that while no rigid system may suit all places, there are no mechanical difficulties that cannot be solved by attention to the local conditions; and finally there are no financial objections which are more far reaching than the others, or which would be serious if the change were made gradually. In the proper municipal supervision of electric wires there seems to be an exact parallel with supervision over buildings. When a city reaches any considerable size the general welfare demands the establishment of fire limits within which the use of inflammable building material shall be restricted. But it has never gone to the extent of compelling owners of wooden buildings within these limits to tear down their structures and replace

them with fire-proof material; neither has it forbidden the use of wood in subordinate parts of the structure or wooden palings and gates in residence streets. It does not refuse permission to prolong the life of wooden buildings by keeping them painted or by stopping leaks in the roof or replacing broken glass. When a great number of wires accumulate in a neighborhood so as to be a nuisance, it is perfectly proper for those who have the welfare of the city in charge to say that the line must not be rebuilt except underground. But what is the difference between ordering the demolition of a line of poles and wires and the demolition of a wooden building, because both are liable to endanger adjacent structures in case of fire, and because both are more useful than ornamental?

The idea of putting all the wires in any city underground throughout their whole extent is not worthy any discussion—it is entirely impracticable. But in any large city the number of wires in the neighborhood of the exchange is a nuisance, both to the public and to the company, and there is no objection, scientific, mechanical, or economic, to putting them underground for moderate distances, until they begin to diverge and scatter to reach individual subscribers. In some cases it is absolutely necessary to cable the wires in order to handle them, and there is very little difference in the working of any aerial and underground cables—none at all if they are inclosed in metal. It would be advantageous to use a special conductor for trunk lines and long extra territorial circuits. This is about all that can be done with the present apparatus and with our present knowledge of the methods of overcoming the difficulties in the way. It is all that has been done in any place and all that any body of lawmakers can compel to be done successfully. It is doubtful if there is a large exchange in the country that would not voluntarily do as much when the present pole lines need rebuilding. The most conclusive experiments that have been made and the most extensive work that has been done thus far have not been under compulsion, but voluntarily. It does not seem that at present we have sufficient data to say absolutely just what length of wire can be worked underground. We are sure that the entire system of any large city cannot be put undeground, for good scientific and financial reasons. We are sure that the entire system of any small exchange cannot, for financial reasons alone. We are sure that a general and extensive local adoption of underground wires would prevent long distance telephoning, except perhaps from office to office. On the other hand, we are sure that when it is required to handle a large number of wires in a small space for a moderate distance no one need fear any bad results from using underground cables. The only thing we are not sure of is the exact length of a "moderate distance." But it is probable that no trouble would be experienced in any place up to the limit of hundred-wire cables—that is, as far from any office as any hundred wires pursue the same route.

In conclusion, to state our creed, we believe in both aerial and underground wires, without bigotry or intolerance towards either, and with due recognition of a suitable and proper field for the use of each. We do not have much faith in the man who says he can put 2,392 wires in a space $2\frac{7}{8} \times 3\frac{1}{4}$ inches; neither do we expect a lineman will be a necessary feature of every circus of the future, to show people how they used to climb poles in the old days of telephone wires.

W. R. PATTERSON.

THE PRESIDENT—Gentlemen, have you any remarks to make upon Mr. Patterson's paper?

MR. SARGENT—I move that a vote of thanks be extended to Mr. Patterson for the paper to which we have just listened, and that it be spread upon the records of the Association.

The motion was unanimously adopted.

THE PRESIDENT—I would like to express personally my thanks to Mr. Patterson for his able and interesting paper. It is quite in the line with my own which is to follow, and I should like to say that in attempting to lay out a lot of underground work, which we are doing this year in Chicago, I ran against so many mechanical difficulties in the way of leading out the wires from the cable, etc., that I modified quite materially the views which I had expressed to Mr. Storke, as to the general completion of our system underground.

[Vice-President Durant in the chair].

President Fay then presented and read his paper as follows:

OBSERVATIONS ON THE USE OF CABLES IN CITIES.

GENTLEMEN—Two years ago, and again last year, I had the honor to lay before you a few "Observations on the Use of Cables in Cities." That use has now become very general, and the conclusions drawn in my first paper are now matters of common experience. Most of us have been driven by our necessities to use air cables, in some cases over distances of two and three miles, and some of us are being driven by our legislatures and city councils to use underground cables. So far as I know, no cable, overhead or underground, when properly made and connected up, has failed to work over a reasonable distance and for a reasonable length of time, and most of the cables which have been put in use are working still. The first broad fact which strikes us is that we have no serious trouble with property owners over whose premises we pass. Once in awhile we strike a case where all ordinary arguments fail, and we must move, but as a rule we are safe in dealing with *them*. On the other hand, we are constantly attacked by our legislators, State and municipal, who, as a rule, have no individual interest to protect from our occupancy. If these last were governed by common sense and the interest of their constituents, they would probably assent to the following propositions:

That a telephone exchange is a direct benefit to all residents of a city or town. That no unnecessary restrictions should cramp its development or enhance its cost to the user. That the public streets were dedicated to public use by the abutting property owners in order to secure forever free access to their property, whether of men, vehicles, water-pipes, light, air, telephones, or any

other thing desirable to their use and comfort. That, therefore, they have a right to such access, so long as the same does not, beyond reason, injure their neighbors. Given these premises and broadly stating the fact that there is a strong popular feeling that all wires should be placed underground, let us consider first, whether there are no circumstances in which public welfare, and with it public opinion, should demand the construction or retention of poles and wires, and afterwards where public welfare and public opinion should require us to place cables when used.

The objections brought against poles and wires are three in number. First and greatest, that they are ugly—an eyesore; second, that they hinder the access of firemen to the fronts of tall buildings; third, that they block the streets. A fourth objection is often made in villages, that they interfere with shade-trees. The first objection, like the fourth, is valid upon handsomely improved streets, but upon streets which are, as the majority of streets are, totally destitute of any attempt at beauty, whose pavements are bad, whose sidewalks are uneven, whose buildings are mean, and their occupancy wretched, it is most emphatically not valid. The second objection is valid where there are many tall buildings, but is worthless where the buildings do not exceed two or three stories in height. The third objection is invalid upon all streets where there are street lamps, hitching-posts, shade-trees, awning-posts, or curbstones. For all these things are commonly set along the curb-line, in line with the telegraph poles, and the blocking of the streets is neither increased nor decreased by the erection of the latter.

Now the description of the majority of streets at the outskirts of any city tallies exactly with the foregoing, viz.: They are not handsomely improved; they are lined with small buildings; they are usually furnished with street lamps, hitching-posts, curbstones, and the like, and neither of the above objections applies validly to the erection of pole lines upon them.

On the other hand, in such neighborhoods telephone users are few and far between; they are commonly manufacturers, retail druggists, or small tradesmen, whose telephones are used by all their neighbors, and their distance from the centre of business makes the telephone well-nigh indispensable, at the same time enhancing its cost. In such localities cables underground or overhead cannot be used, because only one or two wires are required per block, while single underground wires, properly protected, are so expensive that only an occasional user can afford to pay for them. What would an honest, sensible man, or legislator, say in such cases? He would say we must not cut these people off from a valuable means of communication. They came to the outskirts to save money; they are poor and do not care for looks as much as for economy. Let main telephone lines be built on a few of these shabby streets, with branches on short poles, or on house tops, or on any other route upon which the telephone company and the neighboring property owners may agree. These people want wires cheap as possible, and they must have them.

Now turn to those streets which are handsomely improved, where the buildings are high, where the sidewalks are crowded with passers, and are used for handling merchandise, where, in a word, the objections against pole lines are so evident and powerful that any sensible man would say the pole lines must go Must

an honest, level-headed Alderman here insist that every wire be laid underground from end to end after the manner of gas and water pipes? Let us see.

The great and ruling objection to laying wires underground is the inevitable frequent tearing up of the pavements. In the streets last described, already the gas, water, steam, horse railways, and numerous other companies are constantly opening the pavement, blocking traffic and disturbing business. There is no merchant who would not prefer a quiet, orderly telephone pole in front of his door, to an upheaval of the roadbed every few weeks. But every telephone requires its own direct wire direct to the central station. In going underground, therefore, we must, in order to provide for new subscribers, either anticipate them by laying wires to each building, or tear up the streets to reach them as often as they come in. Our Alderman says promptly, put them all down at once, put down enough wires to last you. But *we* know that but about one per cent. of the whole population rent telephones, and that even in the crowded business districts hardly one office in ten requires a telephone. To lay wires in anticipation of business to every building would probably require, therefore, about nine wires, which would *never* be used, to one which would be put in service and earn money. Of course the attempt to carry such an enormous idle plant would be disastrous, unless the expense to the user were correspondingly increased. But our honest Alderman will say, you know that on the average one office in ten will require a telephone. Divide the number of offices in any block by ten and you have about the number of wires which will be required for that block. Lay a cable containing that number of wires from the exchange to the corner of that block, and then you have only to extend each wire a short distance by itself to reach its proper telephone, and the tearing up of the streets will be reduced to a minimum. Why tear them up at all? Why not locate the end of this cable in the centre of a block, and then extend each conductor by a short air line to each telephone therein. We know by experience we shall have no trouble from the property owners in doing this, and we shall cross no streets, so we shall have no trouble with the city authorities. Nay, let us go a step further. Why is it necessary in all cases to lay the cable from the exchange to this distributing point underground? There are many streets already so crowded below the pavement with gas, water and steam pipes, catch basins, reservoirs, sewers and cable railroads, and above the pavement with surface railroads, and traffic, that it is impossible to survey a satisfactory route for electric cables, or to protect them when laid from injury by heat, gas and excavations for these various installations. A gas main leaks, the gas percolates through the ground and collects in a telephone manhole. The next unfortunate workman who enters the manhole with a light is blown up by a fearful gas explosion. A water main breaks, the water floods the telephone conduit and manholes, and finds the joints in the wires. The cables are thoroughly soaked, and as we all know by experience, wet cables won't hold electricity long. Or again, the gas is put into a building. The trench for the service pipe crosses the telephone cables. The Irishman digging the trench strikes his pick through the cable box and injures the cable, covers it up, and goes away. How much delay, expense and interruption of telephonic service must follow such a simple and easy depredation. Still worse than all this for the taxpayers. On many streets new pavements have been laid, and the surface

put in thorough order. The first cable laid along them ruins the level surface from end to end.

Suppose, on the other hand, we arrange with the owners of intervening buildings to run the cable from the exchange to the distributing point over the roofs of these buildings. Our experience shows that we can do this without difficulty. What objection can be urged by a fair-minded city councilman against our crossing the streets from building to building?

The cables, if strung high enough above the roof to clear a man swinging an axe, cannot interfere with firemen. Four or five stories above the ground they cannot blockade the streets. They do not touch the trees. The only thing that can be said is that they are an eyesore. This is true, but to how slight an extent? A cable an inch in diameter, but one in each block for the most part, crossing the street seventy or eighty feet above the eye, is absolutely of no consequence as an eyesore. So little do the passers observe these things, that in the last three years my company has removed from the roofs of Chicago, in its most crowded portion, over 2,400 telephone wires, some of them on racks thirty-six feet high, carrying 200 or more, and replaced them by some thirty cables carried over the roofs on short iron posts, without attracting a word of newspaper comment. Even the owners of the buildings on which these enormous racks stood planted in the middle of the roofs never knew they had been replaced by short iron uprights, supported on top of the fire walls, until notified to that effect by us. Who, then, is injured? The public using the streets are not; the abutting owners of the buildings used have been arranged with. How about the telephone companies? What is the relative value and convenience of a cable over roofs compared with one underground? There is no doubt that, under some circumstances, it is desirable to place these cables in the roadway, particularly long cables running between central offices for use as trunk lines, or in cases where a number of cables cross buildings in the neighborhood of an exchange. Cables underground could not be burned in two by fires, or cut by malicious persons, or suddenly ordered moved by a cranky landlord. Yet, despite all these annoyances from which we have often suffered, I can but think the roofs the proper place for them. The exchanges and the distributing points are, generally, for obvious reasons, under or on the roof. The cables taking a bee line between the points connected are much shorter than where compelled to follow the streets. In case of destruction of an exchange by fire, their ends can quickly be whipped about to a new location. In case repairs are needed, the entire body of the cable is exposed for examination. In short, though their cost of maintenance is probably somewhat higher, the first cost of overhead cables is so much less, and their flexibility and adaptation to the exigencies of service so much greater than that of underground cables, that I am sure they are permanent elements of exchange construction, not temporary makeshifts, as most of us have considered them.

If I am correct in what I have said, an honest clear-headed Common Council, acting strictly in the interest of the public, will not pass iron-clad underground ordinances, which cannot be enforced without burying a large portion of the business and the public convenience along with the wires. Rather will it provide that the Telephone Company, in the outskirts, upon thinly built and badly

improved streets where tall buildings do not predominate, shall erect pole-lines, carrying as many ordinary wires as may be required by the neighboring residents, setting apart certain streets in each district for that purpose, as streets are now set apart for horse-railroads, boulevards and the like. Upon handsomely improved streets, where tall buildings are numerous, in the densely built portion of the city, it will forbid the use of poles, and provide for the carrying of cables to distributing points, over the roofs or under the streets as the emergency may require—but leaning rather to the use of roofs than to that of roadways as less inconvenient for the public. The Telephone Manager will work in entire harmony with the Council, because under such a law the interests of his company and the city are identical.

You all will bear me witness that there is not a new idea in what I have written. That every one of us are practically doing just what is here set forth. Hence the question naturally arises, Why set it forth at such length? Because I have never heard any telephone man come out flatly, and say what we all demonstrate in practice, that the roofs are the natural, proper and permanent place for our cables, wherever they are of such character that they can be used. Most of us regard roof work as of a temporary and makeshift character, and as far as I know have made no effort to have it recognized and legitimitized by statute or municipal ordinance. I think it ought to be, and further, that the law of eminent domain, which has been extended to telegraphs in many States, should be extended to telephones, so as to prevent extortionate or malicious opposition on the part of roof-owners or abutting owners along highways, to the proper and of course *paid-for* use of roofs and ways for telephone purposes.

I hope some one of us may do missionary work in converting his city fathers to this belief. In closing, let me call your attention to two recent occurrences abroad, where the use of roofs is universal, which are a striking commentary on these remarks.

The first in London. A court decided that while two opposite property-holders chose to string a telephone cable across the street between their respective roofs, the vestry of the parish could not interfere to prevent them. Because they owned, each on his own side, the fee of the property to the middle of the street, subject to the right of way of the public—a right which was not interfered with by a cable at that height.

The second in Paris—the city of all the world where underground telephony and telegraphy is in its best development. The Minister of Posts and Telegraphs introduced into the National Assembly a bill authorizing the continuation of the right of way over roofs in cities for telephone and telegraph purposes, because the magnificent subways in Paris were inadequate in capacity and extent to the public demand for wires, and in other cities did not exist at all.

C. N. FAY.

THE CHAIR—Gentlemen, are there any remarks upon the papers of Mr. Patterson and President Fay?

MR. LOCKWOOD—Quite recently there was a committee appointed by the British House of Commons to consider a proposed law in regard to control over telephone wires.

They entered into the subject most elaborately, examined a great many witnesses, all of whom possess great weight with the electrical profession. I have a copy of that report here. If it is the pleasure of the Association I should like to read it. This seems to me to follow Mr. Fay's paper in a very orderly way. It follows up quite naturally the line in which he has written. I have in the office at home the entire evidence upon the subject, and it covers a great deal of ground. The gentlemen who were examined expressed a great number of different ideas. The committee was a very good one, and after considering gravely the evidence presented, this was the result:

REPORT.

The SELECT COMMITTEE appointed to consider the law relating to the control over telephone, telegraph and other wires, have agreed to the following report:

Your Committee have heard evidence from the Post Office, the Telephone Companies, the various local authorities of the metropolis, the corporations of some of the leading provincial towns, and private owners and occupiers.

After careful consideration of this evidence, your Committee have come to the conclusion that the risk of danger to the public from overhead wires has been very greatly exaggerated.

The accidents which have been proved in evidence have been few and insignificant. In the most important instance the fatal result was due, not to the breaking of the telegraph wire, but to a well-meant attempt by a member of the public to replace it.

At the same time, your Committee are of opinion that the probable development of the telephonic system makes it desirable that there should be some change in the law relating to control over wires, with a view to their better supervision.

The present state of the law is briefly this:

The Postmaster-General works under the powers of the Telegraph acts, 1863 to 1878. The acts of 1863 and 1878 give the powers. The act of 1869 gives the Postmaster-General his monopoly. The act of 1868 gives certain powers respecting railways. The powers may be conveniently divided thus:

1. Overground along roads. Consent of road authority first to be obtained. If refused there is an appeal to a stipendiary magistrate or to a county court judge, and a further appeal by either party to the railway commissioners. Permission having been obtained, the Postmaster General: 1. In towns proceeds without further consents, but subject to various limitations, including a provision that he must not place a post within 10 yards of a dwelling-house without consent of occupier: 2. In country he has to obtain various other consents of adjoining owners, to publish notices, etc., with appeals against refusal, etc., and to take other proceedings involving possible long delays. There is also a

similar provision against placing a pole within 10 yards of a dwelling-house without consent of occupier, as in towns.

2. Underground along roads. (1.) In country the Postmaster-General can proceed, subject to certain notices and regulations, without any consent: (2.) In towns he must obtain the consent of the road authority, with appeals against refusal as above, and then he can proceed, subject to notices and regulations.

3. Overground by attachments to property. The Postmaster-General has no powers except in towns; where, having obtained consent of road authority, he may pass wires over buildings or land (not being building land or gardens or pleasure grounds) adjoining or near to the street, subject to notices and restrictions. He has no power of making attachments to private property.

These powers are inherited from the telegraph companies, the right of appeal against a refusal by the road authority or by a private owner being given by the act of 1878. Neither the telephone companies, nor any other persons or companies have any statutory powers. They carry on their business only as licensees of the Postmaster-General, and are governed merely by the general law. They have no power to make attachments to or to run wires over private property. It has, however, been decided by the Court of Appeal that the road authority has no power to interfere with wires passing over roads, unless they interfere with the user of the road, or are a source of danger.

Certain corporations have recently obtained local acts, giving them authority to deal with wire From all these (10 in number) the Postmaster General is excepted. In two cases (Nottingham and Chester), the local authority has an absolute veto on overground or underground wires in or over streets. In four cases (Heywood, Dewsbury, West Derby and Bolton), there is an appeal from this veto to a court of summary jurisdiction. In four cases (Liverpool, Manchester, Birkenhead and Croydon), the corporation may make by-laws on the subject, which must, however be approved by the Board of Trade. Two distinct principles are involved in these acts.

(*a.*) In Heywood, etc. It is a judicial question. The question is between the local authority and the company erecting the wires, and disputes are referred to the county court judge.

(*b.*) In Liverpool, etc. It is an administrative question. By-laws for the regulation of the wires are made, and the local authority administers them.

Having regard to this state of the law, and to the necessity for some alterations in it, your Committee would submit the following suggestions:

Regarding the free development and use of the telephonic system as essential to the public convenience, your Committee cannot recommend any course which would materially hamper its extension. The system of public telephone exchanges, whereby persons at considerable distances apart may converse freely the one with the other, is a great public convenience. The number of subscribers to these exchanges is already over 12,000; the number of messages sent during the year was over 41,000,000; and the average cost per message was less than one penny. This system is daily growing, now that increased facilities have been given for the purpose by the Postmaster-General. In London alone the number of subscribers is nearly 4,000; but the capability of development may be estimated by the fact, that according to the evidence of Mr, Preece (electrician to the Post Office), there are more subscribers to the telephone system in New York and its neighborhood than in the whole United Kingdom, notwithstanding that the charge in New York is about double what it is here. The annual number of messages in London is over 15,000,000.

The companies have recently proposed to place every post office in the London district upon their exchange system, upon any reasonable terms to which the Postmaster-General may agree, so as to afford the entire public of London the means of instantly conversing with subscribers to the system, and similar offers have been made by other companies for towns in their districts; and the committee therefore recommend that the erection of overhead wires should be continued, subject to proper regulation and supervision.

In order to obviate the delays and difficulties experienced by the Post Office in laying down wires, especially along roads, it is proposed that the Postmaster-

General should be authorized to give notice of the intention to erect any telegraphic line before, if he thinks fit, instead of after, obtaining the consent of the road authority. Such notice to be advertised and posted in the street affected in towns, and in the country to be also left (as at present) at any dwelling house with 50 feet of the road, and to be served on the occupier of any park or pleasure ground.

All persons (including the road authority) desiring to object to the mode in which the proposed line is to be carried, should send in their objections to the Postmaster-General within a stated period (say three weeks), and all objections not so sent in should be barred.

All objections so made should be referred to a competent tribunal, which should be empowered to make an order authorizing the erection of the line on such conditions as may be deemed just, and to make such order as it may think fit as to the costs occasioned by the several objections.

This tribunal might conveniently be the county court judge (sitting as an arbitrator) of the district within which the property in respect of which the objection is made is situate. The county court judge should be substituted for the police magistrate, where the jurisdiction is given at present to the latter tribunal.

If an appeal from the county court judge is thought necessary, this might properly lie to the railway commissioners, as at present; but the Postmaster-General should be authorized to proceed with the erection of his line if the appeal to the railway commissioners is not prosecuted within a fixed period (say one month) of the decision of the county court judge.

The Postmaster-General should be allowed to make attachments to private property with the consent of the occupier, and should not be obliged, as at present, to obtain the consent of the lessee and owner, subject, however, to the condition that consent of the occupier held good during the term of his occupation only.

The provision of the existing acts inconsistent with the foregoing suggestions should be repealed, and especially the provision requiring the Postmaster-General to obtain the consent of the occupier of every dwelling-house within thirty feet of a pole.

The telephone companies occupy a position somewhat similar to that occupied by the old telegraph companies, save that they are acting under the license of the Postmaster-General, to whom they pay a large royalty, estimated at present at the rate of £20,000 a year, and likely to increase if they are given reasonable facilities for the service of the public. It is proposed by the representatives of the Post Office, and your Committee recommend, that the licensees of the Post Office should have the same powers with regard to the running of their wires as the Postmaster-General; subject, however, to the proviso that the wires of the company should not be permitted to interfere with those required for the general public telegraphic service by the Postmaster-General.

Your Committee are of opinion that, under proper regulations, permission should be given to pass wires over property without the owners or occupiers having the right of prohibition; but this facility should confer upon those enjoying it no vested interest or easement, and should not relieve them from any claim for damage occasioned by them.

They should be required to remove or alter their wires if the premises were about to be raised, or for any other good cause shown; and the occupier should be given an appeal to the local authority to order the removal of the wire, in case he could show special circumstances which caused the same to be an injury to him or to his property.

With regard to attachments; these can only now be made either by the Postmaster-General or by any person else, with the consent of the occupier and owner. In certain cases it may happen that it is impossible to obtain access to premises for the purpose of connecting them with the general public telephonic system, owing to the refusal of an individual to permit an attachment.

It was given in evidence that many of the inhabitants of the Inner Temple

are desirous of being connected with the telephone exchange, but that the telephone company is unable to obtain permission to run wires for them. It was also given in evidence that a similar prohibition has been exercised in the case of Covent Garden.

Your Committee think that in special cases, where it could be proved to the satisfaction of the local authority on investigating the whole circumstances, that certain individuals or certain districts were debarred from the public convenience of telephonic communication owing to such refusal, the local authority should be authorized to give permission to attach wires to premises under suitable regulations and on payment of such compensation as the local authority might think just.

By-laws for the regulation of all wires, as to substance, length of span, durability, and other matters, and for their identification and inspection, should be made for the whole of London by the Metropolitan Board of Works, for provincial towns by the Corporation, for rural districts by the Local Authority, in each case subject to the sanction of the Board of Trade. In London the enforcement of these by-laws should be intrusted to the Corporation of the City, and to the vestries and district boards.

For the protection of the public it is necessary that there should be a ready means of dealing with every wire.

For this purpose every wire should be identified, and the by-laws should provide for the best method of identification, by registration or otherwise, and for the removal of all ownerless wires.

Your Committee believe that such regulations as they have recommended will be abundantly sufficient to protect the public from inconvenience and danger, however wide may be the extension of the telephonic system.

At the same time they believe that nothing which they have recommended will impede the natural development of an invention, the great and increasing utility of which they fully recognize.

May 12, 1885.

MR. SARGENT—I would like to ask whether Parliament has taken any action on the Committee's report?

MR. LOCKWOOD—I do not think there has ever been any action taken upon it, beyond the submission of the report, because Parliament was prorogued very shortly after the report was made.

THE CHAIR—Gentlemen, do you wish to remark further upon this matter?

MR. HOTCHKISS—I move that a vote of thanks be given to Mr. Lockwood for the interest shown in bringing before this Convention the interesting paper which he has just read.

MR. METZGER—I amend that by making a motion that it be printed with the report of our proceedings.

Both motions were adopted.

MR. METZGER—I move that the paper of President Fay be received by the Association and spread upon the minutes,

and that the thanks of the Association be tendered to Mr. Fay therefor.

The motion was unanimously adopted.

(President Fay resumed the chair.)

MR. SARGENT—It may interest the Association to know something about the way we are working in Brooklyn. I have in my hand the so-called "Underground Bill." The bill passed June 14, 1884, was a sort of drum-head court-martial.

This first bill was amended by another, which was passed on the 13th of June, 1885, which latter provides for the appointment, by the Mayor of the city of Brooklyn, of three commissioners, who are charged with the duty of enforcing this amended bill and providing for placing the wires underground. Under this act we are required to place before the commission plans for any underground work that we may desire to do.

The text of the bill is as follows:

CHAP. 499.

An Act providing for placing electrical conductors underground in cities of this State and for Commissioners of Electrical Subways.

PASSED June 13, 1885; three-fifths being present.

The People of the State of New York, represented in Senate and Assembly, do enact as follows:

SECTION 1. Within twenty days after the passage of this act, in any city of this State having, according to the last census, a population exceeding five hundred thousand and less than one million, the Mayor of such city is hereby authorized and directed to appoint, and in cities having a population exceeding one million the Mayor, Comptroller and Commissioner of Public Works of such cities are hereby authorized and directed to appoint three disinterested persons, residents of the respective cities for which they shall be appointed, to be a Board of Commissioners of Electrical Subways. Such Board shall meet as soon as practicable after such appointment, and shall then organize by the election from their number of a President and Secretary of the Board. The Board shall give at least ten days' notice, in a daily paper published in such city, of the time and place of such meeting.

SEC. 2. The said Board of Commissioners is hereby charged with the responsibility of enforcing the provisions of an act, entitled "An Act in relation to Telegraph and Electric Light Companies in cities of this State, passed June

fourteenth, eighteen hundred and eighty-four, as amended;" and the said act is hereby amended and made to conform in all respects to the provisions of this act, and it is hereby made the duty of said Board of Commissioners to cause to be removed from the surface and put, maintained and operated underground wherever practicable, all electrical wires or cables used or to be used in the business of any such company in any street, avenue or other highway in any such city, so as to enable and require all duly authorized companies operating or intending to operate electrical conductors in any avenue, street or highway in any such city as is or shall be affected by the provisions of said act, to transact their business with underground conductors wherever practicable.

SEC. 3. When any company, operating or intending to operate electrical conductors in any such city, shall desire or be required to place its electrical conductors or any of them underground in any of the streets, avenues or other highways of any such city, and for that purpose to remove the same from the surface thereof, and shall have been duly authorized to do so, it shall be obligatory upon such company to file with said Board of Commissioners a map or maps, made to scale, showing the streets or avenues or other highways, which are desired to be used for such purpose, and giving the general location, dimensions and course of the underground conduits desired to be constructed. Before any such conduits shall be constructed, it shall be necessary to obtain the approval by said Board of said plan of construction so proposed by such company; and said Board has and shall have power to require that the work of removal and of constructing every such system of underground conductors shall be done according to such plan so approved, subject at all times to such modifications as shall from time to time by the Board be made, and subject also to the rules and regulations not inconsistent herewith, prescribed or to be prescribed by the local authorities having control of such streets, avenues or other highways of such city.

SEC. 4. It shall be the duty of said Board of Commissioners to carefully investigate any and all methods proposed by any such company for electric lighting or electrical communication by the use of conductors along or across any street, avenue or other highway in any such city. And before approving of any such method, said Board of Commissioners shall require that, so far as practicable, all such conductors when constructed shall be underground, provided no suitable plan is proposed or in use within sixty days after the passage of this act, it shall be the duty of such Board to cause to be devised and made ready for use such a general plan as will meet the requirements of said act and of this act. And the Board shall have full authority to compel any companies operating electric wires to use such subway so prepared in accordance with the provisions of this act.

Wherever in the suburbs or along the streets, avenues or other highways in sparsely inhabited or unoccupied portions of any such city the public interests do not require the electrical conductors to be placed underground, and whenever, in any other locality of any such city, it is deemed by said Board to be, for any cause, impracticable to construct and successfully operate underground the electrical conductors required by any such company, then, and in either of those cases, it shall be the duty of said Board of Commissioners to examine and grant the application of any such company to deviate therefrom an underground system. But the Board shall not grant any such permission unless the Board shall be satisfied, upon investigation, that such a permit should, and for one or the other of the reasons hereinbefore stated, be in such case granted, and that it will not interfere with the successful working of underground conductors elsewhere in such city. Any such permit shall be held and construed to authorize the construction and maintenance of the lines of conductors therein provided for, as and where prescribed by the Board.

It is hereby made the duty of said Board of Commissioners, in granting any such permit for other than underground electrical connections, to bear in mind the policy and purpose of this act, which is to convert the overhead system of electrical wires and cables now in use in said cities to underground systems as

soon as possible, without impairing the efficiency of their service; to require that, as far as practicable, all electrical conductors in any street, avenue or other highway of any such city shall be removed from the surface and placed and operated underground as soon as may be consistent with the convenient use thereof by the public. And that it is intended hereby to authorize other than underground electrical conductors to be used in the streets, avenues or other highways of any such city only when and where the public interests do not require the electrical conductors to be placed underground, or when and where it shall be deemed by the Board itself to be impracticable to place and operate advantageously underground as aforesaid; and that it is hereby intended to make all aerial or other electrical connections incidental only to such underground methods, and to require that they be authorized only when and where needed for the convenient use of the public, or where the underground conductors can be made thereby more useful. The work of constructing every line of conductors authorized by any such permit so granted shall be subject to the rules and regulations not inconsistent herewith, prescribed or to be prescribed by the local authorities having control of such streets, avenues or other highways in such city. Every such permit shall specify the location of the structures to be erected and to be used for sustaining the electrical conductors, and shall give the general dimensions thereof, and a copy of every such permit shall be filed by said Board of Commissioners in the office of the Mayor of such city to which it relates, and shall be recorded there in a book to be provided and kept for that purpose, which shall be at all times accessible to the public. It shall be the duty of the said Board, in devising the aforesaid plan, so to devise the same that the subway may be used by any such city for the electric wires or conductors operated by its police, fire or other departments, without expense, except the expense of the wires or conductors; but no such city shall be compelled to place any such wires or conductors under ground until the money has been specifically raised therefor by the proper authorities, and until that time any such city may continue to use and extend such wires in the same manner as though this act, and the act referred to in the second edition of this act, had not been passed.

SEC. 5. Whenever said Board of Commissioners, in carrying out the provisions of said act, shall permit any aerial electrical wires or cables to be carried along or across and above the surface of any of the streets, avenues or other highways of any such city to be crossed by aerial electrical wires or cables, it shall be the duty of the Board to designate also, in such permit, the route and location thereof, and to prescribe and regulate the height at which such wires or cables shall be placed, and it is hereby expressly provided that when any such permit shall be granted by said Board of Commissioners, in extending the connections of any subterranean electrical conductors for the erection of any structure or structures for sustaining electrical conductors above the surface of any highway, or for placing wires or cables on any such structure or elsewhere than underground, or for carrying any such wires or cables across or along and above the surface of any highway, or for placing wires or cables on any such structure or elsewhere than underground, or for carrying any such wires or cables across or along or above the surface of any highway, or over or into the rear or in the rear of any building or block in any such city, any and all such structures, and any and all such wires or cables shall be so erected and maintained as not to incommode the other public uses of such streets, avenues or other highways.

SEC. 6. The term of office of such commissioners shall expire on the first day of November, eighteen hundred and eighty-seven, or sooner upon the performance of their functions as herein prescribed. Each of the commissioners so to be appointed, and each of his successors in office, is and shall be removable for cause, but only upon notice and after an opportunity to be heard by the Governor of this State, who has and shall have power to fill any and all vacancies, however caused in the office of either of the commissioners hereinabove named.

SEC. 7. The salary of each commissioner and of every successor of either of

them, if appointed for either of said cities having a population of more than one million, shall be five thousand dollars per annum; and if appointed for either of such cities having a population of less than one million, shall be three thousand dollars per annum, payable quarterly by the Comptroller of this State, who shall also audit and pay quarterly all necessary and incidental expenses of each of such boards of commissioners. The amount of such salaries and expenses shall be by the Comptroller assessed upon and collected from the several companies operating electrical conductors in any such city of the State, which under the provision of said act are or shall be required to place and operate any of their conductors underground, and the amount of any such assessment shall be paid by the company upon which it is so assessed to the Comptroller in installments, or oftener as and when required by him.

SEC. 8. It shall be the duty of every such company to furnish the Comptroller, from time to time, as and when requested, all data by him desired, to enable him to apportion the relative share to be paid by each such company of the expenses of said and of the salaries of said two commissioners, such estimate to be by the Comptroller made with reference to the number of miles of wire operated within the limits of any such city, and the several companies interested to be by the Comptroller assessed ratably according to the number of miles of such wires, which the Comptroller shall certify to be operated by them respectively.

SEC. 9. All maps, books and papers of said Board of Commissioners relating to electrical conductors in any such city shall, at the expiration of the term of office of such commissioners, be filed in the office of the Mayor of such city, and shall be there kept at all times accessible to the public.

SEC. 10. All acts and parts of acts inconsistent herewith are hereby repealed.

SEC. 11. This act shall take effect immediately.

In the appointment of the commission authorized by this act the Mayor showed great wisdom and judgment by appointing two gentlemen of well-known scientific attainments, the third being a member of the legal profession. They have taken up the subject in a very common-sense way, if I may say so, and appear to be disposed to construe and enforce the law with a very liberal spirit. We placed before them a plan for constructing underground conduits and for running cables therein. The commissioners have so far approved of our plan, and have given consent to lay conduits over a distance of perhaps a mile and a half, and have generally approved our scheme of laying conduits and putting in cables. They do not consider it is their province to decide upon questions of the merits of different conductors or cables; our plan appeared to be perfectly feasible to them, and we are now going ahead.

THE PRESIDENT—How extensive is your plan? How far do you go?

MR. SARGENT—We presented to the commission a plan showing the extent of our whole line and the distribution of

our subscribers, and exhibited a plan of the underground work we had already done, which consisted of a series of conduits into which we had drawn cables, including 425 wires, and said we believed the same plan could be applied to our whole system, and asked permission to extend the same plan on Fulton street, 4,200 feet in one direction, and 4,000 feet, if my memory serves me, in the other direction. When asked what we proposed to do farther than that, we said that was but the beginning; that we had a great deal to learn, and they had something to learn, and that we would ask for further permission after this work was done.

MR. METZGER—What arrangements for distribution have you?

MR. SARGENT—We do not see our way to running wires to single subscribers; we believe that in the progress of the work we may find some plan by which we can run wires to every subscriber underground, but at present we ask for poles in localities from which we can distribute fifty wires; we do not believe that we can take the wires away where they number fifty or less. We have asked about the same privileges that the commissioners in the District of Columbia have given to the telephone company there. They finally agreed to give us that privilege, with the understanding that we would dispense with distributing poles just as soon as possible.

THE PRESIDENT—Then you still have the poles on your main street? You expect to plant distributing poles along Fulton street?

MR. SARGENT—We will clear Fulton street, if possible. The distributing poles will be placed either in the alleys or the side streets. The commissioners suggested that we could occupy the roofs of the fire-engine houses, police stations and the school houses throughout the city—all the buildings controlled by the city authorities—for the purpose of distribution. They are co-operating with us, and trying to arrange to give us authority to occupy these roofs for that purpose.

THE PRESIDENT—I do not see what advantage you gain in carrying the line off of the street, if you retain distributing poles on that street. In the dense part of the city you will have to get at least one distributing pole on a block. You will have a shabby-looking pole, with the cross-arms on it twisted out of shape, and so far as symmetry is concerned you will have gained nothing. That consideration was the reason why in our practice I had determined to go into the centre of the block for a cable distributing point.

MR. SARGENT—The commissioners are very much opposed to granting the distributing poles. They do not say whether they will or will not grant them, but I apprehend they will permit them in extreme cases. In case they do not, we shall have to avail ourselves of some convenient housetop.

THE PRESIDENT—I notice the language of the act under which these commissioners are appointed has some flavor of liberality about it. It gives the commissioners discretionary powers, to allow the erection of poles for conductors and wires wherever, in their opinion, it is necessary to do so.

MR. SARGENT—It gives the commissioners entire discretion.

THE PRESIDENT—It seems on the whole to be a much more liberal law than I had any idea that it was—much more liberal than anything we have in our part of the country.

Is there any further discussion to be had upon this matter, gentlemen? If not, we will pass to the next subject. I understand that Mr. Wylie has something to offer on the subject of underground cables, and of a particular underground cable. Gen. Sherwin has promised us some remarks on the subject of telephone accounts, and there is about sufficient time to receive them now before the hour of adjournment.

MR. WYLIE—Allow me to withdraw in favor of Gen. Sherwin?

MR. LOCKWOOD—Mr. Wylie's paper is quite brief, and he could give it to you in a very short time.

THE PRESIDENT--Within what time can you bring your paper, Mr. Wylie?

MR. WYLIE—Ten or twelve minutes.

THE PRESIDENT - We shall have to hear you to-morrow, then. Will Gen. Sherwin now read his paper?

GEN. SHERWIN—Your Secretary asked me to write a few remarks on the subject of "Accounts," to open a discussion on that subject, and I have prepared this paper, which I will now read:

ACCOUNTS.

The telephone business of the United States has long since passed from the experimental stage of its existence. Its development during the past seven years has been more rapid than that of any other which has grown up within this generation, and it has now taken its place as one of the recognized and important industries of the time, the facilities which the telephone affords constantly becoming more valuable as its operation has been more widely extended and perfected to those who employ it in the transaction of their affairs.

In its prosecution are now invested in the United States more than fifty millions of capital, employing directly about 6,000 persons, and indirectly probably an equal number. There are now in operation 1,250 principal and branch exchanges, through which are connected 140,000 subscribers, using in the transmission of messages 130,000 miles of wire.

The requirements of a business of this magnitude have called into requisition abilities of men of the first order, both in the scientific and practical field. Year by year new and improved appliances have been adopted, mechanical difficulties studied and overcome, better and more costly plant substituted for that which had proved inadequate for the growing needs of the business. With the lapse of time also the deterioration of material such as poles, wire, bells, etc., has made itself apparent, and in general the life of the telephone plant has been found shorter than we were at first inclined to estimate. It is safe to say that within the past five years the larger number of all the exchanges have substantially been rebuilt and newly equipped. The expenditure incident to these extensive changes and improvements has been a very sensible addition to the estimated cost of operating upon which the rates to subscribers were originally based, and has called the attention of those having the direction of telephone companies to the problem to what extent the necessity for change and reconstruction is likely in the future to become a charge upon the earnings of their companies.

Especially within the past year a closer inquiry has been made into the several classes of expense which go to make up the grand total of the cost of furnishing the best attainable service to our patrons, and more careful consideration given to the form of the accounts through which the operations and results of the business are shown.

An improved, and in its substantial features, uniform system of accounts has now been adopted quite generally, and many companies are now making such analyses of their earnings and expense accounts as exhibit with accuracy from what sources the profits of their business arise, and suggest the means by which all branches of the business may be placed on a more satisfactory paying basis.

The accounts of a telephone company should be kept so as to exhibit the true condition of its affairs, and show at the close of each month the actual earnings and expenses under appropriate classification for the portion of the financial year which has expired, and in such form that the specific earnings and expenses of each exchange of the extra territorial system or other distinct branch of the business for any month can be readily made up.

I think the accounts may conveniently be kept under the following heads, though some companies have found it desirable to make still further subdivision of several of the accounts :

ACCOUNTS, *Dr.*	ACCOUNTS, *Cr.*
Licenses.	Capital Stock.
Rights of Way.	Surplus.
Investment.	Reserve :
Construction :	1. For Unearned Rentals.
Subdivided.—Exchange.	2. " Depreciation.
Private Line.	3. " Doubtful Accounts.
E. T. Line.	Outstanding Toll Tickets.
Bells.	Accounts Payable.
Merchandise.	
Personal Property :	
Subdivided.—Office Furn. and Fix'rs.	
Tools.	
Horses, Wagons, etc.	
Accounts Receivable.	
Stocks and Bonds.	
Cash.	

Expense Accounts :	Earnings Accounts
1. General Office.	1. Exchange.
2. Insurance.	2. Tolls.
3. Taxes.	3. Extra territorial.
4. Stationery and Printing.	4. Private Line.
5. Extra territorial.	5. Telegraph Comm's.
6. Private Line.	6. Messenger.
7. Messenger.	7. Miscellaneous.
8. Rents.	
9. Operating.	

10. Pole Rents.
11. Repair and Maintenance.
12. Reconstruction.
13. Rebates.
14. Prop'n A. B. T. Co. Ex. Terr. Receipts.
15. Prop'n A. B. T. Co. Telegraph Receipts.
16. Rental A. B. T. Co.
17. Miscellaneous.

Dividend Account.

Most of the above accounts, which constitute the usual balance sheet, require little comment, as but one way of keeping such accounts would ordinarily present itself. Those which call for our special consideration, and which it is important to keep upon a uniform plan, in order that comparisons of results between the companies may be made of value, are those representing the earnings and expenses, and, in connection with the latter, the construction account.

Of the earnings, tolls, extra territorial, telegraph and messenger receipts, which are reported and paid in monthly, will naturally be credited as of the month in which earned. It is desirable that the exchange and private line earnings should also be so credited.

Where bills are rendered quarterly in advance (or, in case of private line rentals, yearly), each exchange should be charged with the total of bills rendered, earnings being credited with one month's proportion, the balance being carried to the credit of unearned rentals. With each succeeding month of the quarter unearned rentals should be charged, and earnings credited for that month's proportion. In this way the accounts will show actual, and very nearly uniform gross earnings, month by month, varying only with the increase or diminution in the volume of business and number of subscribers; and if certain yearly charges, such as taxes, are distributed, month by month, as they may be with approximate accuracy, a certain uniformity of net earnings will be attained, barring such serious and unforeseen expense as the company may be subjected to by damage to the plant from storm or other disasters.

I think it most important to aim at this equalization of earnings and expenses month by month. Most boards of directors meet monthly, and desire to have some statement presented to them of the progress and results of the business, and to compare these results with those which have previously been reported.

Such statements to be of value should be as near the actual facts as possible, and free from the perpetual qualification that, in one case, the monthly earnings would be considerably larger, but that from it the entire tax for the year, or other fixed charge, has been paid, or in the other, that though the statement shows unusually good results, allowance should be made for a similar account which has not been rendered, and in both cases that the actual gross revenue for the month has not been accurately stated.

The opening of an unearned rental account has been regarded by some as a formidable undertaking, and an innovation upon established usage. It is now,

however, kept by most companies without difficulty, and without involving much additional labor.

By some companies a fixed sum is kept through the year to the credit of this account. As, however, a larger number of rental bills fall due in one month than another, the monthly earnings, though actually about the same, are made to show differences of considerable amount.

In the case of one company, part of whose exchanges pay quarterly in arrears, the others in advance, or monthly, I have suggested the plan of keeping an auxiliary book, showing the total annual rental made up from the subscribers' ledger. The new contracts and discontinuances, with amounts representing the gains or losses in rentals, are entered upon opposite pages of this book, and the balance of total rental carried over at the close of each month. Crediting earnings with one-twelfth of this sum, and unearned rentals with the balance of accounts receivable (due from subscribers), gives the measure of monthly earnings from this source, the accuracy of which may safely be left for verification at the close of the year, by reference to the individual accounts in the subscribers' ledger. This accomplishes the desired object, without resort to some fictitious account to represent revenue already earned, but payable at the end of the quarter.

Of the expense accounts, general office may include salaries of general officers and clerks, rent, light, fuel and incidental expenses of the executive and financial officers; operating, the salaries of exchange managers, operators, and other employees engaged upon the regular exchange work, supplies and care of batteries, fuel, light and incidental expenses.

By some of the companies both these accounts are subdivided, so as to show salaries as a separate account.

The repair account includes the cost of maintaining lines and apparatus in serviceable condition, replacing worn-out wire, poles and equipment.

Reconstruction represents the cost of rebuilding exchanges or lines, substituting poles for housetop structures, cables for open wires, improved for inferior apparatus, or in general such change of plant or operating property as replaces a defective or antiquated system with that which affords superior facilities for the transaction of business.

Most of the other expenses, whether pertaining to the work of exchanges or other departments of the business, can readily be classified under one of the other expense titles above given, and with this classification the book entries can easily be made, so as to afford an analysis whenever desired of the cost of operating an exchange, or other branch of the business.

It has sometimes been difficult to determine, where some extensive work of rebuilding has been done, where the dividing line should be drawn between construction and reconstruction—the former a property, the latter an expense account.

With most companies construction is employed to show the value or cost of the operating plant, though with some a separate investment or property account is kept, representing the value of properties acquired, already built and equipped.

In either case the additions to the construction account should represent

new value added to the plant, and affording capacity for enlargement of the business.

As regards reconstruction, the more conservative practice is to charge expense with such changes as simply afford better facilities for transacting business. Such as result in enlarging the capacity of the plant should be charged to construction, and this account should then be credited, and reconstruction charged (except for the value of old material for sale or other use) with the cost of the original plant.

In the case of a company just established, whose exchanges have yet to be built and whose revenues have yet to be created, the initial expense, including salaries, must of necessity be charged to the property account. With a company whose exchanges are built and whose business is substantially established, whose development consists only in the ordinary and gradual increase for which we may look in towns of any commercial importance, I think nothing beyond the expenditure which can be directly attributed to the acquisition of new property should be charged to the construction account.

The salaries of general officers, managers, inspectors, canvassers—of the whole corps of employees whose services would still be required for the maintenance of the business if its volume remained unchanged—should be charged to expense.

Any method other than this results in burdening the construction account with a nominal valuation, which latter appraisement must prove to be excessive, and in encouraging in the minds both of stockholders and the public an exaggerated idea of the value of the property and the profits from the business which is likely to prove embarrassing to the managers of the company and prejudicial to its interests.

I find that some companies close their books quarterly, but the larger number yearly, the dividend account then being carried in full upon the books to the end of the year.

On some accounts the latter method is preferable, as in this way the trial balance for any month gives a complete showing of the business of the company for that portion of the year which has elapsed.

The business of the telephone company consists of a large number of transactions, each of small amount, and which can be readily classed under a few general heads. For most of the business the unit, for accounting purposes, is the exchange or division, so far as the principal books, the ledger and journal, are concerned; and the large number of personal accounts with subscribers on the one side and employees on the other, can advantageously be consigned to the subscribers' ledger and the voucher book respectively. Both the ledger and the journal should be kept as concisely as is consistent with an accurate showing of the company's condition and business.

The ledger accounts should embrace those before enumerated, a separate construction account for each exchange ; and for the extra territorial and private lines, an account with each exchange or in the name of the manager, and with those other departments whose business is conducted independently of the exchange, and of necessity a few other personal accounts.

I think with the aid of proper auxiliary books, the journal entries covering a

month's transactions of a company having the average number of exchanges need not occupy more than a dozen pages.

The subscribers' register or ledger, showing both sides of the individual's account, is now regarded by most treasurers as indispensable, relieving the principal books from an enormous amount of detail.

Similarly the book of extra territorial earnings affords the footings from which, in a few lines, the journal entries representing the month's receipts may be made.

The payments as shown by the cash book should, of course, be capable of verification by the vouchers on file, while an additional and convenient verification of the cash receipts is afforded by a sheet of daily or weekly collections, signed and handed in to the Treasurer by each of the employees authorized to receive payments, and placed on file, showing each payment, the source whence received, and on what account.

I find it the usual practice to include in one voucher the monthly expense of a single exchange, enclosing the sub-vouchers in a wrapper, which gives the distribution of expenses, and affords the material for the journal entry.

In some cases a voucher book, with separate columns for construction and the various classes of expense, has been found to work satisfactorily. In this book the amount of a single voucher, though including the monthly construction and expenses of an exchange or long line system, distributed as above indicated, occupies but one line, and the several construction items and the footings of the expense columns make a single entry in the journal, the credit being "audited vouchers." From this book and the several earnings credits, a sheet may be made up, exhibiting the entire results of the business of each exchange or division, and of the company, month by month, rentals and general expense being entered either in gross, or apportioned pro rata to the several exchanges or systems,

I think this sheet, which can also be made from the various journal entries where the voucher book is not used, of great value, as it affords officers and directors, in a comprehensive form, the means of comparing the results of work in the various localities in which the company operates, and of judging whether any class of expense is disproportionate to the amount of business and the revenue.

In addition to the usual books of accounts there should be kept in every company a record of property, showing the mileage of wire, number of poles, fixtures, switch-boards, and other articles constituting the plant and equipment, with the date of purchasing, building or rebuilding. Such record would give valuable data, bearing upon the question in which all telephone managers are interested, of the average durability or life of the plant.

In this paper I have given a very general outline of the method in which, as it seems to me, the accounts of the telephone companies may advantageously be kept. The system should be such as affords ready means for proving the accuracy of the work, and detecting errors and irregularities. The accounts should be concise, free as possible from unnecessary multiplication of figures, so clear, consistent and complete, that an intelligent director or stockholder can follow the work through the books, without the aid of the book-keeper to supply

from his inner consciousness the missing links in his process which his books fail to afford. All ambiguities, complications and misleading titles should be avoided. I believe that the best title for an account which conveys to the average mind most clearly the nature of the property, liability or transaction which it is used to represent.

With the work thoroughly systematized, and with convenient printed forms, the best method need not be more expensive and laborious in its application than the inferior one. It will prove less so in the end.

MR. SARGENT—I move that the thanks of the Association be tendered to Mr. Sherwin for his valuable paper, and that he be requested to allow the same to be spread upon the minutes.

The motion was unanimously adopted.

MR. DURANT—In connection with this paper, I would like to ask what we are to understand by "maintenance."

GEN. SHERWIN—The title, as I understand it, that is commonly used is that of "Repair and Maintenance Account," which is the expense of keeping the plant already constructed in serviceable condition, that is, in replacing worn-out or broken parts, such as pieces of wire, decayed poles, etc., as distinguished from "Reconstruction," which means the rebuilding of a line or plant, such as an exchange office or long line, or any considerable work, which is virtually a replacement of the entire old plant with a new.

MR. SARGENT—In that plant do you understand to be included your poles, wires, switch-boards, bells and all the paraphernalia of the whole business?

GEN. SHERWIN—Yes, sir; the repair account is capable of being subdivided, of course, so as to show what the expense is attributable to—whether to the repair of central offices, or of long lines. My intention was to include in the general account repairs of all.

THE PRESIDENT—In my experience I have had considerable difficulty in separating "Reconstruction" and "Maintenance;" I doubt that there is any good reason for doing so, except that your "Reconstruction" comes in big blocks, and it throws your "Maintenance Account" out, so that you cannot compare, month by month, one account with the other. Is there any difference that you know of?

GEN. SHERWIN—I think that seems to be one very good reason, and then in the nature of things there seems to be an essential difference. If you take an exchange which was originally poorly equipped, and find it necessary to rebuild the line, find that it is inadequate for the necessary work, and that it should be entirely rebuilt, you substitute practically a new plant where the old existed. That is an illustration, in my mind, of what is a reconstruction charge; so with a long line which comes into a company's possession which they found constructed on light poles, unsuitable for the wants of the company. Where new poles are substituted that I should call a reconstruction charge; while the replacement of parts of the line which might become weak, and while it was not necessary to alter the character of the line, to change it from a lighter to a heavier line, would seem properly to be a "Repair" expense. And so with central offices: where one system of switch-boards is removed and another put in its place, it is a very essential change, which I should call "Reconstruction."

THE PRESIDENT—Those changes in switch-boards occur about once in a year and a half or two years on an average, and of necessity it is always a new one each time you put it in. It seems to me that it had better go in as "Maintenance."

MR. BAILEY—I understand Gen. Sherwin to recommend that in that matter, say of the switch-boards, their construction has to be counted every little while as partially an addition to the property, and only a part of it goes to "Expense." Suppose you reconstruct a central office and place in it a switch-board to accommodate a thousand wires, where you had originally 300. Seven hundred of those ought to go to property account or construction; the balance is charged to expense or maintenance.

THE PRESIDENT—That was Gen. Sherwin's suggestion.

MR. BAILEY—I should think that was proper, also in case of a rebuilt line. If you had a line that would carry only a dozen wires, and you re-built that line with larger poles that would accommodate 200 wires, the difference would

go to "Construction"—to your plant, and only a portion be charged to the "Expense" of renewing the line which formerly existed.

MR. DURANT—The question is, which would be the best method?

THE PRESIDENT—The best method is that of which you can make use. The object is to keep your accounts, so that by examining the balances from month to month the variations indicate of themselves the directions in which to economize. For instance, take the "Reconstruction" account and the "Repair and Maintenance" account. If you keep the latter separate, on the average it should run about equal, and in case of an unusual increase in any month's "Repair and Maintenance" account, you can call upon your superintendent for an explanation of that increase, find out what it means, and if it means some neglect or oversight on his part, you can "go for him" and see that it does not happen again. What is still more valuable is that gradually, year by year, you can keep your eye on various accounts, reduce your expense, getting it down lower and lower by intelligent use of your balances. I think in each exchange the circumstances, the nature of the territory that each company operates, has to be taken into account, and you have to open your accounts as you can use them. Don't you think so, Gen. Sherwin?

GEN. SHERWIN—I don't know as I quite understood your question; but I suppose that in all companies which had been long in existence, all these accounts would naturally be used, and that by following along, comparing one with the other, month by month, would be a very convenient way by which the directors could trace the real value of their business.

THE PRESIDENT—That is exactly what I meant. But I have found considerable practical difficulty in arranging the accounts so that they indicated exactly where troubles lay. For example, take "Repair and Maintenance" account: it may be made to include "Inspection," or a separate account may be kept of "Inspection." In the latter case it becomes

more of a check upon your inspectors, to detect, for instance, whether they are using too much battery material, or changing zincs too often. My experience is that the finer the subdivision is made, the more useful it becomes in every case.

GEN. SHERWIN—Very much so. My suggestions were intended to cover a general plan of accounts, and I can see that, of course, as time goes on, companies may find it desirable to go into closer subdivisions for purposes of examination and comparison.

MR. DURANT—There are two accounts that never recommended themselves to me, namely: "Maintenance" and "Reconstruction." "Reconstruction" represents the actual depreciation of the company's property. The "Maintenance" account I take to be the minor items, as they are generally stated—small repairs, that would also be chargeable to that account. It has seemed to me confusing, where I have found in reports of telephone companies, "Maintenance" and "Reconstruction" and "Repairs." I could never thoroughly understand such reports. It seems to me there is no room for "Depreciation" account where the "Reconstruction" account represents the entire outlay to keep the lines in position.

THE PRESIDENT—Gen. Sherwin says that when apparatus is removed, in case of reconstruction, that credit should be allowed for the cost of the old apparatus, and the value of the new one charged in its place. For instance, you have given a man a magneto bell—we will take the case of a telephone being taken out—you charge the cost of putting it in to "Construction." When it is taken out, how much does the value of that plant lose by the depreciation of that telephone? It is the wear and tear from the time it was put in till the time it was taken out. You lose the inside wires running and a portion of the outside wire running. In large companies that occurs several hundred times a year. Two or three hundred telephones, it may be, will be taken out, and the average loss on those telephones is not less, probably, than $15 or $20 a piece. But how to get that

into the depreciation account, in an accurate way, has always seemed a mystery to me. The amount of reconstruction we have done, replacing property not worn out, but that had become inadequate to do the business, has always been so large with our company, that I felt that it was a fair allowance—that it would average up large enough to cover the loss arising from this taking out of subscriber's telephones.

GEN. SHERWIN—Don't you think that ultimately you will come to the practice of charging to "Expense" account the connecting from a new line to the houses.

THE PRESIDENT—Even then we shall still charge the magneto bell, the battery, etc., to "Construction" account. Mr. Durant was saying that he did not like the word "depreciation." A general account of that kind is the only one we can make. You can estimate the "depreciation" arising from things of that kind at the close of the year in business. That is the only way I can see that you can get at things of that kind.

MR. DURANT—My objection is to the *approximation* or *estimation* of the amount we charge in any account.

THE PRESIDENT—Now in regard to the disconnection of subscribers and the removal of apparatus that has once been charged to "Construction."

MR. DURANT—We dispose of it in this way: We have an "Abandoned Material" account. If it has been brought to the supply room it goes to "Abandoned Material" account. The same with line material. If we reconstruct a line of poles we take the old poles and put them into "Abandoned Material." It is a sort of dormant account, and only appears on the face of the books when money is realized from the sale of old material. When thirty-foot poles are taken down the labor of setting the other poles and wires is all charged to "Reconstruction" and "Repairs." Where these are replaced by poles of greater length we charge the difference to "Construction." Those poles go into "Abandoned Material." When those poles come out again, then we credit them to "Abandoned Material," and that is one of the most convenient accounts we have.

THE PRESIDENT—Suppose this case: You buy a magneto bell for $8.50. You put it on a line. It remains there two or three years. When it comes out it is worth about a dollar. Do you charge a dollar to "Abandoned Material" and deduct that amount from the cost of making the change?

MR. DURANT—We charge "Abandoned Material" simply in bulk and quantity. If we take out a magneto bell we charge it simply as "Magneto Bell." Then if it goes into service again, it simply appears as "one magneto bell," of no given value whatever. When that bell is sold or exchanged, and we realize some money for it, we credit that account just exactly what we received from the manufacturers for it.

THE PRESIDENT—The point I wish to bring out is, that we are constantly adding to our plant, charging every year a little construction right along. The value of our plant, apparently, is constantly increasing. We are taking off from the other end subscribers, but not cutting down the value of our plant.

MR. DURANT—We had that property in our possession before.

THE PRESIDENT—But it is not good for anything. It is worn out, and the labor expended in putting it up and taking it down is also gone.

MR. DURANT—If it is in your supply department. and you think it is more desirable to sell it than use it, realize upon it at once. If it is preferable to use it, put it out again. Let it disappear from "Abandoned Material," and it is the same property you had before. You have not lost a cent.

MR. CARSON—You remember the story of the girl who was asked what she did with her dresses when they became too short for her. She said, "let out a tuck." We have not come to the point of poles that are worn out and are not good for anything any more. Our practice is exactly as stated by Mr. Durant. If we take away a bell from a subscriber's station we repair it and put it in some other place, and the expense of repairs goes into "Maintenance"

account. The plant is charged for the construction, and is left just the same. The plant we assume to be just as good as it was in the first place. It is the same way with all the rest, the "Repairs" and "Reconstruction" accounts being charged with all that belongs to them, the plant is supposed to be continually kept up to its original standard, and there is no necessity of "Depreciation" account.

THE PRESIDENT—That is very true of those subscribers that remain in service. But what becomes of those who do not, those that are taken out? You keep up a plant that is working. We have taken out a thousand telephones. The cost of putting them in was charged to "Construction" account. I tried to keep an accurate account of each telephone whenever it was taken out. I credited to "Construction" that amount, but it got to be too complicated. After awhile I charged it to "Profit and Loss," I think, or rather I charged it to "Abandonment;" that was the name of the account. You put a great amount of labor and material in a subscriber's account, and then you have taken it out and not credited "Construction" account with anything at all.

MR. DURANT—The only way to get at it would be to have two construction accounts, "A" and "B," A to represent the actual cost of the live plant, and B to represent that part of it which goes into disuse by disconnection of subscribers or other causes. If we have these two construction accounts and know the actual value of that portion of the plant which is dormant, we should be in a very nice condition. But that would lead to very complicated accounts.

THE PRESIDENT—The only feasible plan is to charge off for "Depreciation" at the end of the year, about enough, as near as you can get at it, to cover those items.

MR. DURANT—I cannot agree with you there; I object to any estimating.

MR. HALL—There is one other safe road to be followed in adding the amounts to "Construction" account, and that is, it should bear, without some very fair explanation for an undue increase, some relation to the net gain in subscribers.

I think that money enough should be spent on the plant in use to keep it thoroughly good. Everything should be kept up in perfect working order; and if the exchange at the end of this year has no more subscribers than it had at the beginning of the year, and there have been no items charged to "Construction" account which are clearly in the nature of improvements and additions to the property, the "Construction" should be charged with nothing, and whatever has been spent for new subscribers is to be charged to "Profit and Loss." If our business does not gain, our property has not an increased value. If the "Construction" account then is charged with any enlarged amounts, it should be explained clearly, in our own minds and to the directors, just what that value consists in, whether in constructiou of extra territorial lines, or large pole lines, or in simply replacing some part of our property which has been discontinued. We would then have a pretty safe gauge. I have seen a great many reports which did not bear any explanation on their face as to what the added value of the property was; and I have noticed in some cases where a very large amount was charged in the annual report to "construction" account and the net gain in subscribers was very insignificant. It seems to me that in such a case as that there cannot very well be any very great increase in the value of the property, and it would be safe enough to say that the depreciation had wiped out a great deal of that investment, and the property was worth at the end of the year practically what it was at the beginning. Mr. Durant makes a mistake like this: Construction represents not the value of a plant, but the cost of its construction. If "Construction" account is increased $10,000, it means that $10,000 has been expended for construction purposes. It may not be actual work. Suppose we construct an exchange of a thousand subscribers, 500 go into disuse. That does not affect the "Construction" account at all. The "Construction" account represents the cost of producing those thousand wires.

GEN. SHERWIN—Would it be safe to carry in the books for any length of time the value of a plant which had be-

come permanently destroyed? Would it not be advisable in that case to set up a "Depreciation" account, and wipe out the value of that disused plant?

MR. DURANT—That might come later in the business; but there does not seem to be the least possible occasion for it now.

THE PRESIDENT—Every losing concern has a magnificent balance sheet—shows a great amount of property. When you come to look for the property it is not there; it has only a lot of "old rattle traps," that will not sell for one quarter of their cost. They figure out profits and great dividends, but when it comes to paying their debts they have nothing to pay with.

MR. DURANT—That does not successfully refute my argument. If such concerns had charged to their "Construction" account, or whatever account they represented their plant by, the actual cost of their building and their machinery, that was the true account to charge it to, and the true representation of that property. If their machinery had depreciated, and there was no enlargement of it, why, to render a true statement of it, and an intelligent one, there should have been a "Depreciation" account.

If all the machinery and houses were in as good serviceable condition, as when "Construction" account was charged with them, I think their books would be correct. No telephone plant would sell for 30 per cent. of its cost, except for use for the one purpose for which it was built.

THE PRESIDENT—When we find a concern with nominal assets of a million dollars, that are really worth but two or three thousand dollars, you see where the trouble arises. The history of business is full of the wrecks of manufacturing concerns that have figured out profits and made dividends, because they didn't charge anything for the depreciation of machinery.

Are there any further remarks upon this paper? If not, I will state that the time for adjournment has arrived.

To-morrow we will have a paper upon the "Multiple System," by J. J. Carty of the New England Telephone

Co., also, if Dr. Plush is here, a paper on the "Law Multiple Switch-board." There will be discussion on those papers, and possibly one or two papers on the underground system. We shall finally adjourn at 1 o'clock and proceed to the steamer "Philadelphia," for the excursion upon Narragansett Bay.

The Convention adjourned to meet on Thursday, September 10, at 10 o'clock A. M.

THIRD DAY'S PROCEEDINGS.

MORNING SESSION.

THURSDAY, September 10, 1885.

The Association re-assembled at 10 o'clock A. M., the President, C. N. Fay, of Chicago, in the chair.

THE PRESIDENT—I have been informed by Mr. Doolittle that the proposed excursion to Leicester on Saturday next has been abandoned, as so few members of the Association will be able to participate.

The first business in order this morning is the reading of a paper on the "Multiple System," by J. J. Carty, Esq., of the New England Telephone Company of Boston.

CAPT. STONE—Before proceeding to the order of business, I desire to correct a possible error in the report on "Exchange Statistics" presented yesterday. I was absent during the meeting. I am impressed by the reading of the report in the papers this morning with the idea that possibly there was considerable guesswork done in making the reports on ten consecutive connections. Assuming that I have all the privileges accorded to any member, I desire to change the record and indulge in a little guesswork myself. I did not make that experiment myself, but it was made by a young man in the employ of the company. I *guess* he intended to write "seconds" instead of "minutes." I

would like to correct the report of my exchange, so that the time of the ten consecutive connections should read "twenty-three seconds" instead of twenty-three minutes. [Laughter.]

MR. WYLIE—At your afternoon session yesterday I desired to read a paper descriptive of the cables of the Standard Underground Cable Company. There seemed to be some slight feeling of opposition, and I withdrew. I desire now to make the withdrawal permanent, desiring to be guided not only by your rules but by the feelings of your members.

MR. METZGER—I understand this morning that a number of the honorary members of this Association, principally manufacturers, held a meeting at which it was resolved that an assessment of $40 shall be levied on each honorary member as a contribution to this Association. I now move the following: That it is the sense of this Convention that no contribution shall be received from any honorary member. It seems to me a kind of beggarly way for this Association, representing millions of dollars capital, to receive from honorary members a contribution of money. If the active members of this Association are not able to maintain the organization, it should die. And it does seem to me that there is not a company represented here that is not able to contribute not only $50, but $100 if necessary, to maintain the organization.

CAPT. STONE—I second the motion offered by Mr. Metzger.

MR. CANDEE—I don't think we manufacturers should be put exactly on the plane of "honorary members." Honorary members are debarred from being taxed or having to pay dues of any nature. If the by-laws could be so changed that manufacturers could come into the Association as "associate" members, with a voice but no vote, as heretofore, and allowed to pay certain dues, it would be much better than the present manner, and then we might have other strictly "honorary" members, such as we don't care to have pay any money to the Association.

THE PRESIDENT—The Chair would say that the suggestion of Mr. Candee has been anticipated in the amendment presented by Mr. Hall to be acted upon at the next meeting, and it is therefore merely a question of accepting an assessment for the current year. I quite agree with Mr. Metzger that we are in no danger of bankruptcy for the immediate year, and the whole matter might be relegated to the action of the Convention a year hence. However, the question is before the house. Does any member wish to speak upon it?

MR. EASTABROOK—Having taken the position I did yesterday, I do not think I will be misunderstood when I say that in my view of the matter, although at variance with Mr. Metzger and Capt. Stone, and possibly with the whole membership of the Convention, I fail entirely to see what objection there can be to receiving any voluntary contribution from such gentlemen as under the change in the Constitution may hereafter become "associate" members. I am decidedly averse to fixing the resolution or shaping our actions, so that we might seem to be expecting a contribution from purely honorary members, and I should feel that we are getting into another delicate position if these gentlemen think they are giving us value received for the benefits they are deriving from the Association by any contribution they may see fit to give. Speaking of manufacturers, I shall not be against accepting any voluntary contribution. I shall vote "no" upon Mr. Metzger's resolution, and to bring the matter to prompt action I move that the resolution be laid on the table.

MR. STORKE—I second the motion of Mr. Eastabrook.

MR. KER—I think that we might be committing an error by taking the ultra ground that we ought not to accept any contributions from honorary members. I think we ought to take into consideration their desire to contribute. They feel that they are receiving benefits, and wish to share with us in the burdens of the Association.

MR. METZGER—It seems to me that this Association owes something to its own honor and dignity. None of these

honorary members were elected under any provision that they should pay any dues or assessments. There is an express constitutional provision that they should *not* do so. Are we here in the attitude of beggars, of men receiving voluntary contributions from manufacturers? Do we owe them anything or do they owe us anything? Not at all.

MR. STORKE—We *owe* them, Mr. Metzger [Laughter.]

MR. METZGER—Not as an association. I do not know as I owe any of them anything. I call for the question on the motion to table.

On the question of laying Mr. Metzger's resolution on the table a division was called for, and the motion to lay on the table was lost.

The question then recurred upon Mr. Metzger's resolution that this Association do not receive voluntary contributions from manufacturers who are honorary members. A vote was taken and the resolution was adopted.

MR. STORKE—I voted against that resolution with a feeling that to pass it would in some sense be perhaps a slight on the manufacturers, and I would now move a vote of thanks from this Association to the manufacturers, for the generous offer which they have made of pecuniary assistance at this time, and which the Association has seen fit to decline. A vote was taken upon Mr. Storke's motion and it was unanimously adopted.

THE PRESIDENT—You will now listen to the paper by Mr. J. J. Carty, of Boston, on "The Multiple System."

Mr. Carty then read his paper as follows:

THE MULTIPLE SYSTEM OF SWITCH-BOARDS.

The multiple system is too well-known to require description here, and the arguments for and against it have been heard so frequently that I need not repeat them.

In order to show what can be accomplished by the use of the system I have thought best to give some results already obtained from its working at Boston.

Boston is chosen not only because it is the largest plant in operation and embodies all of the latest improvements, but because there some very difficult conditions were met, and a description of how these conditions were fulfilled will give a very good idea of the value of the multiple boards.

At one time the Boston exchange consisted of one large central office, with a few small branch offices within the city limits. This state of affairs has changed during the past few years, owing to the rapid growth of the suburban business, so that to-day Boston has twenty-one branch offices, which include, with the central office, some 4,500 subscribers.

This multiplication of branch offices has been the cause of much unevenness in the service, which was expected to be materially lessened by the introduction of the multiple system.

The extra territorial business also required special attention. Boston is within easy speaking distance of more than nine hundred thousand people. This means great possibilities for toll business, but its growth heretofore has been seriously retarded on account of the impossibility of giving it proper attention with the old apparatus. It was necessary that the multiple system should be sufficiently comprehensive to admit of handling a large extra territorial business in the near future.

With the old boards but few more subscribers could be added, on account of the lack of connecting strips. The multiple boards were required to have an ultimate capacity of over 4,000 lines, or more than double that of the other boards.

Of course the introduction of the new system was expected to result in a great improvement in the general service.

Another important requirement was that the boards should be practically free from "cross-talk," and that the cables furnished should be moisture-proof, because the air of Boston is unusually damp.

Still another requirement was that the work with the new boards be performed with fewer operators.

Having named the conditions laid down, I will show how far they have been complied with.

After the boards were put in operation, there was a gradual improvement in the service for about a month, which was no doubt due to the increasing efficiency of the operators.

At this time improvement ceased, leaving the service at a point far below the standard, and without effecting the desired saving of operators.

The principal difficulty was with the branch office service, and arose from the fact that when a subscriber wanted a branch office party, he gave the number to the central office operator, who had to repeat the call to the branch office. It frequently happened that while waiting for a branch office to answer, a number of calls came in, all of which were neglected until the central office operator got her answer and repeated the call.

To avoid these annoying delays subscribers were asked, when calling for a branch office number, to call for the office at which the number wanted is located, and having obtained that, give the number to the operator there.

When the subscribers became accustomed to the new way of calling a great improvement was noticed, and it soon became about as easy to take care of a branch office call as one which is strictly local. This branch office business has been referred to somewhat at length, because it is the weak point in all systems, and should be carefully looked to by those introducing the multiple boards.

In order to get the best results from the multiple system, some means must

be provided for an operator to throw off immediately all slow work, such as branch office and extra territorial calls, message business, complaints, etc.

It is a very easy matter to do this, and a number of methods suggest themselves at once to anyone who goes into the subject.

Let us now see how the extra territorial business was provided for. For reasons already indicated, the extra territorial business had not assumed the proportions warranted by the situation, yet about thirty-four lines had to be provided for at once, and arrangements made to accommodate more than double that number. To do this the following plan was adopted: ten wire toll-boards were set up, to which the extra territorial lines were led direct, without going through the regular switch-boards. Each of these toll-boards was provided with cords and plugs connecting with a special switch-board, presided over by a listening operator. Now, if an extra territorial party wants a number in the local exchange, it is simply necessary for the toll operator receiving the call to telephone the listening operator and have the line wanted plugged to the toll-board. In this way one switch-board can be made to serve ten or more toll-tables. In the case of a subscriber in the local exchange calling for an extra territorial point, it is simply necessary for the local operator to plug the subscriber's line to a spring jack which connects with the proper toll operator. The act of inserting the plug throws a drop on the toll table, which is to be answered at once. The subscriber waits to give his call to the second operator, after which the connection is run off by the toll operator from the local operator's table, and that ends the matter as far as she is concerned

The actual connection with the extra territorial line is made direct through the toll room switch-board, only one pair of cords and one drop being in circuit, and it is managed so that the drop can be shunted if desired.

The extra territorial plant proved a most satisfactory feature of the service from the beginning, and owing to the improved work done the toll receipts have considerably increased.

There is no reason why this system cannot be extended to an almost unlimited extent, and wherever a large number of toll operators is required it is especially recommended.

Owing to lack of space in the main exchange a separate room had to be provided for the toll business. This is to be regretted, as experience clearly shows that the business for a long time to come can be better and more economically handled in one room than in two. Attention is called to this, as a separate toll room has been recommended by some who claimed for it special advantages, none of which it is found to possess.

As to the provisions for growth, it has already been shown that they are ample in the case of the toll lines, and in regard to the local wires, when we consider that the ultimate capacity of boards is practically 4,000 lines, it seems enough to satisfy the demands of growth for some time to come.

In regard to the effect of the introduction of the multiple system on the service in general, it must be said that it has resulted in a gratifying change for the better; and although there is still room for improvement, the service is very much superior to anything ever known in Boston.

In connecting the boards a very much larger amount of cable was used than in any previous installation, and grave fears were entertained of trouble from

induction, retardation and leakage. Talking through the boards, however, proved to be better than before, and no trouble is experienced from any of the above causes, except when a loud-speaking transmitter is used, and then conversation can be heard on adjoining lines. This is not to be wondered at, as the same, and even worse effects have been observed on the so-called "straight" boards.

This practical immunity from "cross-talk" proves that the cable used is moisture-proof, and that the anti-induction appliances adopted are effective. The cable referred to is a form of Patterson cable known as the lead-tape variety, so called from its envelope of lead tape or foil, which keeps out moisture and serves as an induction shield, being connected to a ground. It is important to note that, although each line passes through eleven switch-boards, the talking has not suffered, but has actually been improved. The fact of this improved talking has been noticed and commented upon even by subscribers. This result is obtained, because the line is not obliged to pass through a drop on each section of switch-boards, but is carried through a cable of high insulation, and whenever it appears at the face of a board, is led through a spring-jack, which measures contact and all, a very small fraction of an ohm.

It is well known that lines which pass through a number of ordinary switch-boards never work well. This is for three reasons:

First, there are always two or more drops in circuit, and it can be shown that the presence of even one electro-magnet in a line exercises a retarding effect on the current.

Second, there are apt to be poor contacts caused by the plugs used in making the connection.

Third, there is always more or less loss of current due to leakage.

The first two causes, as might be inferred from what has been said, are not present in the multiple boards, and no trouble is experienced from the third, because the total surface of eleven spring-jacks which is exposed to leakage is not equal to that offered by one line and connecting strip in an ordinary board.

A comparison of the operating force of last winter under the old system with that of to-day, working the multiple system, shows a decrease of twenty five per cent. in favor of the latter. The plant in the old office consisted of thirty-four fifty wire and five twenty-five wire Gilliland boards. There were about 1,650 subscribers, ninety branch and thirty extra territorial lines. The extra territorial lines were handled by five operators on the twenty-five wire boards, on each of which there were a dozen or so subscribers. This called for a force of thirty-nine operators on tables at any one time, seven operators for relief and seven night operators, making a total force of fifty-three. With the multiple system only twenty operators are required to fill the boards in the main exchange, with five relief and four night operators. In the toll room, eleven operators are required, including the chief, one relief and two night operators. This makes a total of forty operators, handling 1,700 subscribers, 152 trunk lines, and shows a saving of thirteen operators.

The present equipment will accommodate 200 more subscribers, and if it is not found necessary to add more operators when the boards are full (and the

indications are that it will not), a still further saving of two operators will be made.

From the fact that the operators at the new boards were obliged to care for a larger number of lines than before, it was feared that they would not be able to work the required number of hours, and would have to be frequently relieved. This has not been the case, however, as owing to the comforts with which they have been surrounded, and the remarkable ease with which connections can be made by the new system, the operators have really a much easier time than before. How much work an operator can do at a multiple board in a day is an important question for those about to adopt the new boards.

At Boston, operators frequently attend to 700 calls a day, and think they could make 900 without any hardship. At Pittsburgh 750 calls a day is considered very good work, and about 700 calls a day are being made at Louisville, but the manager there thinks this number could be increased several hundred without overworking the operator. The New Orleans people consider 1,500 calls a fair day's work for an operator at their boards, while at Indianapolis the number is set at about 1,000. Twenty-two hundred and twenty-six calls were made by an operator at the Nashville boards the other day, and she was not the most expert operator, neither was it a busy day.

Two of the objections most frequently urged against the multiple system are, breakage of cords and poor contacts in spring-jacks. Out of eleven hundred cords in use since May 1 but three have been broken, and they have been repaired and are now in use. The cords used are a combination of tinsel and spiral wire suggested by Mr. Keller. But two faulty contacts have occurred in twenty-seven thousand spring-jacks, and those resulted from accidents. In view of the fact that we may adopt the metallic circuit system, I would say that the present form of multiple board can be used for the metallic circuit without any radical changes.

These are the results we have obtained from the workings of the boards thus far at Boston, and in my judgment I consider the switch-board problem solved.

J. J. CARTY.

THE PRESIDENT—Gentlemen, you hear Mr. Carty's paper; will you remark upon it?

MR. SARGENT—I move that Mr. Carty be requested to furnish a copy of his paper, to be spread upon the minutes of our proceedings, and that the thanks of the Association be tendered him for his very able and very interesting paper.

The motion was seconded by Mr. Storke and was unanimously adopted.

MR. SEELEY—Mr. Carty remarked, at the conclusion of his paper, that it is not a well-known fact that the multiple board can be used for metallic circuits. I beg to differ from

him. It is a well-known fact that there are some lines now dependent upon the metallic circuit multiple switch-board. I simply want to make that statement a matter of record.

MR. CARTY—The reason I stated that it was not a well-known fact, was because a gentleman very prominent in telephone circles stated on this floor yesterday, that in order to change from a ground circuit to a metallic circuit system, it would be necessary to have entirely different arrangements for switching, and enlarged upon the difficulties of connecting the metallic circuits together. From the fact that nobody arose to contradict him at the time, I inferred that it was *not* a well-known fact; and although Mr. Seeley is undoubtedly well posted in the matter, I think it is not a well-known fact.

MR. SUNNY—I would like to ask Mr. Carty one question. He said that the air in Boston is very damp, and on that account particular efforts were made to get a cable for that was moisture-proof. We have a great deal of difficulty in Chicago from plugs becoming rusty, and when we introduce the parts together we have a great deal of resistance upon the plug and the spring-jack on account of the rust. It is very difficult to go over all the plugs and sandpaper them down. Do you, Mr. Carty, have that same difficulty, and what do you do to prevent it?

MR. CARTY—We propose to use our plugs so much that they will keep bright from use; but there is one table, located near a window, where we have the difficulty that Mr. Sunny mentioned. Our boards are so situated that the plugs all receive about the same amount of use. I think the process of using them keeps them bright.

MR. LOCKWOOD—Of what metal are they?

MR. CARTY—Either iron or steel; I do not know which.

MR. BARTON—I should say that they were probably made of soft iron.

MR. SUNNY—Our plugs are undoubtedly kept bright from constant use; but the rust accumulates in the night, and we have to go to work in the morning and clean things up before we are in condition to give good service.

THE PRESIDENT—I would like to ask Mr. Carty how many wires each operator is working now?

MR. CARTY—Each operator has a hundred drops, and they are answering calls from about ninety stations. There are probably ten or eleven vacant drops on each operator's section.

THE PRESIDENT—How many connections are asked for on those wires per day?

MR. CARTY—The figures returned to the Association show that our subscribers average six calls per day.

THE PRESIDENT—So you would say that about 540 calls a day are answered by each operator?

MR. CARTY—Yes, sir.

THE PRESIDENT—Now, do you expect that average to increase as the size of the exchange grows?

MR. CARTY—Well, I think it should.

THE PRESIDENT—You think a growth of 4,000 subscribers would still leave your operators able to answer ninety wires?

MR. CARTY—I do; because that number of subscribers will not be reached for a long time, and during that time our operators will continue to improve; every additional day that they work the board they show improvement. It seems to be a matter of speculation at present, to say how we would handle 4,000 subscribers in one office; yet, in my opinion, if we had 4,000 subscribers, each operator could handle a hundred drops.

THE PRESIDENT—How many calls should you estimate they could answer on a hundred drops?

MR. CARTY—I have never gone into that question; but it certainly would not be over a thousand.

THE PRESIDENT—You feel that an operator could handle a thousand connections a day without difficulty?

MR. CARTY—I have stated in the paper that the operators themselves say they would not have any hardship if they had to answer 900, and in my opinion it would not be necessary to add any more operators if they had a thousand calls.

THE PRESIDENT—You think the operators, for the ten hours of the day, could answer one and a half calls per minute?

MR. CARTY—I do not know how that would be.

THE PRESIDENT—There are six hundred minutes in a day of ten hours. Making 900 answers, the operator would have to make one and a half completed connections, including disconnections, for every working minute in the day; and as most of that work would be done between nine o'clock and four o'clock, there would be times of the day when the work would very much exceed that. Do you think that that could be done with ease?

MR. CARTY—I do. I would not like to induce any one to adopt the multiple board upon my recommendation, and then have them find they had made a mistake. But in the matter of the "ten consecutive connections" I followed the instructions given in Mr. Sunny's circular. I called up eight subscribers from my own instrument in the central office, and the eight connections and disconnections were made in one minute and fifty-two seconds.

THE PRESIDENT—How long did it take the operator to become familiar with the fact that you were calling for "consecutive connections?"

MR. CARTY—I think she found it out very quickly.

THE PRESIDENT—I guess so.

MR. CARTY—But that does not change the fact that she could do it. The method may have been a little faulty in the respect that any operator who was bright enough to handle a hundred lines would soon see that something was up.

THE PRESIDENT—Would she not naturally think that something was up if a subscriber called for ten consecutive connections in the course of business?

MR. CARTY—I think she would.

THE PRESIDENT—We have in Chicago been able to make very rapid connections where parties called for a great many connections consecutively, the most satisfactory test of a system being where the parties are connected in different exchanges connected by trunk lines.

MR. CARTY—But these tests which I made did not represent the actual time consumed by the operator in making the connections—they included also the time consumed by the subscriber in going to the telephone. The circular said we could chose those who had the reputation of answering promptly, and I did so.

THE PRESIDENT—I was going to observe that you had a smarter set of subscribers than we have.

MR. CARTY—It is part of the business to educate subscribers up to answering promptly.

THE PRESIDENT—Certainly; you deserve credit for that. I was very anxious to get exact information as to the number of subscribers that could be handled by an operator. Our own experience has been that the constant increase of business has compelled us to allot fewer and fewer wires to each operator; and I do not think that in a busy season an operator can handle over forty. We cannot handle over forty to fifty subscribers with one operator.

MR. LOCKWOOD—How many connections a day can an operator handle?

THE PRESIDENT—In Chicago, in the neighborhood of four hundred.

When I was Chairman of the Committee on Exchange Statistics, as Captain Stone said, there were traces of a great deal of "guess" work, and I never could believe in some of the extraordinary records attributed to operators; and without casting the least doubt on Mr. Carty's statements of the number of calls that can possibly be answered by an operator on a multiple board, I would like to ask how he made up that statement?

MR. CARTY—I addressed letters to all of the exchanges using multiple boards, asking them their opinion on this question: "How many calls can an operator handle from day to day, with no relief except at noon?" I received replies from all those mentioned; and in one case I deducted twelve or fifteen hundred calls from the number they gave me. [Laughter.] In the case of the Indianapolis Company their opinion was that the operator could make twenty-one

hundred and sixty calls per day, but in actual experience they were making about half that number. I placed it at a thousand. In New Orleans they said a fair day's work for an operator was fifteen hundred. That seemed incredible to me.

MR. FOWLER—I would like to explain the New Orleans report. I believe the inquiry was, "How many connections do you think an operator can make on a multiple board in a day?" We stated sixteen hundred as among the possibilities.

THE PRESIDENT—Our experience has been that the actual matter of making connections does not take a great deal of time. But the operator has much more to do. She has to "get the parties together" and watch the "ring off," and the result is that it reduces the efficiency of the operator very much below what it would be if she had nothing to do but make the connection and go away. An operator is often "stuck" by a slow party, who does not understand. If you are considering the question of introducing a multiple board, particularly in a large system, it makes a great difference whether the multiplying is based upon fifty wires or a hundred. If you make it on the first basis and then find that you have loaded the operator with more work than she can do, you are put in an embarrassing position.

MR. CARTY—If, in Boston, we ever find that the operator has too many drops to answer, we can put in an extra operator between each two. I believe that plan has been in operation in Pittsburgh and Louisville, and the arrangements were substantially these: to have one hundred drops to each operator, and an extra transmitter set up between each two, which could be used by a relief operator to go in and help out at a busy time. So, when we get 4,000 subscribers in Boston, if we find that an operator cannot handle one hundred lines, we can put in another operator very readily, without changing our plant, simply putting in another operator. As long as one operator can handle a hundred lines we need not do that, of course.

MR. DURANT—I would like to ask whether Memphis was

among the exchanges from whose statements you deducted fifteen hundred calls per day?

MR. CARTY—No, it was Indianapolis, where they said it was their opinion that they could make twenty-one hundred and sixty; that in actual practice an operator could make about half of that number. In order to be on the safe side I took the one-half. I think it fair to state that they are making a thousand calls a day in Indianapolis. In the case of Nashville they reported as I stated that from observation and actual count an operator upon a board, not long ago, answered 2,206 calls, and that she was not an expert operator, and it was not a very good day for calls. And they further stated that they considered an operator could make, day after day, without any relief except at noon, twenty-five hundred calls. I just submitted that without any comment.

MR. LOCKWOOD—Mr. Carty's report of the Nashville statement reminds me of a report furnished from Clinton and Lyons, of Iowa, in response to a statistical circular sent out by the National Bell Telephone Company. Mr. Gouch was at that time the superintendent of the exchange, and was something of a humorist. In reply to the question, "What compensation do you pay to operators?" he wrote, "Nominal." In another column was the question: "What suggestions can you give us for the benefit of the business?" to which he replied, "Give us more territory and let us alone." [Laughter.] A third inquiry was to this effect: "What is the chief cause of complaint from subscribers?" He filled that out "Pure cussedness." I am glad to say that from the point of view of a subscriber I can corroborate the statements contained in Mr. Carty's very able paper. I do not know of any paper submitted to this Association which has pleased me more, because it has given me information which I was very desirous to obtain. But any one who knows anything about the Boston system, after it suffered the terrible calamity a year ago last January, when it was burned out by an electric light current—any one who has had to sustain the weight of managing that exchange

between that time and the time of the introduction of the new boards, and also the subscribers who had their connections severed at that time, to any of these, it is quite evident that the present state compared with the former is a perfect paradise. The transition was wonderful, and I am constrained to say that the way the business was managed while the New England Company was putting in the new boards was marvelous also. The wires were brought down stairs in a makeshift way, as you will understand when I tell you there was not a single wire standing Saturday morning, and by Tuesday morning nearly every wire in the exchange was in running order. I do not think too much credit can be given to Mr. Carty for the able way in which he has brought order out of that confusion and has set up the new exchange boards.

From my experience with the new board I can corroborate his statements.

During the first month there was constant, steady improvement. The first day was quick, the second was quicker, and by the end of the month it was quicker still. And the talking was wonderfully improved. The talking between subscribers was loud, clear and good, and when it was not, it was to some defect in the subscriber's own outfit. But after a month it did become a little slower, I found, not from my own instrument, because I always get good service there. I don't know whether it is from the fact that we have got the best operator, or because our instruments are from the Bell Telephone Co's. office, or because Mr. Carty favors us more than anybody else ; but we have always got good service. Going around among subscribers I found there was complaint, after a time, in regard to slowness. Two troubles were developed, and Mr. Carty may explain how they were produced and how they can be remedied. The principal trouble was, that while we could hear subscribers that we were talking to, and hear everything that was said, we could not always hear what the central office operator said, and *vice versa*. Everybody seemed to talk well except the central office operator. That trouble continued for awhile.

I think it was on account of some faulty method of connecting the central office telephones, which was remedied. The other trouble I have experienced within a very few days. Suppose I call for 93, and I put my telephone down; I do not keep on listening. I get a ring. I answer very quickly, put the telephone to my ear and say "Yes." Then I get another ring. I answer, "I am here;" and then I get another ring. By that time it gets to be monotonous, but the same thing is repeated over and over again. Then I call up Mr. Carty and ask him why he does not cultivate his operator's taste for music, or words to that effect; and he explains it in the old way, in which the Captain of Midshipman Easy's ship used to, that it was "zeal," on the part of the operator, zeal to get us; and no doubt it was. It was, I venture to suggest, a misdirected zeal. He would say that the operator was not used to have subscribers put the telephone to their ears so quickly. Now, while in central offices conducted by managers with as much zeal as Mr. Carty, the operators will doubtless imbibe by contact a portion of the zeal themselves. I do not know anything more likely to develop dissatisfaction on the part of a subscriber than to have the operator ring in his ears four times instead of once.

There is one thing more. If any central office contemplates adopting the multiple switch-board, and has not already adopted the method of denominating the subscribers by calling them by numbers, I would say that it is well to do that first, and get the subscribers well drilled into it, before they adopt the multiple board. In Boston they have been using it for many years. So the double trouble did not commence there. I was in Baltimore eighteen months ago, when the subscribers were all known by name. They were going to change that, and they were also introducing the multiple board at the same time; and the operation of the new multiple boards was somewhat premature, because the old boards fell to pieces about a week before the new ones were expected and the change had to be made very quickly, and the change from names to numbers, and from the old

board to the multiple board resulted in producing a condition of things very like a pandemonium for three or four days. If anybody is going to introduce the multiple boards they had better get the numbers drilled into the subscribers first.

MR. CARTY—In regard to the first trouble you spoke of it has been eliminated, and was caused by something which will not occur again, and no future plants will ever be troubled with it. It was only as a matter of history that it is worth mentioning. I did not refer to it in my paper.

MR. LOCKWOOD—What was the cause?

MR. CARTY—In connecting the telephone on to the line, instead of looping in we got in a diverted circuit around the annunciator, so that when the central office spoke three parts of the current was diverted from its course to the subscriber's telephone on to another track where it did not belong. But we loop in straight now, and are not having any trouble, and nobody else will have to contend with that trouble again. With regard to the trouble of ringing in the subscriber's ear that cannot be a very serious objection. When a subscriber complains of it, I tell him it is something which he must expect if he has anything to do with the telephone system. It is not going to do his ear any harm. Tip the telephone away from his ear and he will not have any trouble. If they complain of it in Boston, I do not know what subscribers can say in places where they press a key, which rings out both ways at once.

MR. FOWLER—About what is the duration of the ringing by the subscriber?

MR. CARTY—We try to make it very brief. It is a matter that I have not had to go into. We are not troubled very much with subscribers ringing half an hour. Once in awhile we hear of one. I answered a call from one who said he "had been ringing half an hour," and the operator showed that he had made a connection for him ten minutes before.

MR. FOWLER—I find a great deal of delay on multiple boards, attributable to the subscriber's disposition to give long

and loud rings, and in order to attain the best results we found it necessary to insist on a short ring from our subscribers, and also to insist on their answering the telephone promptly. When the man rings twice or three times, or continuously for half a minute, I take it for granted that he has plenty of time, I will not take the trouble to answer him, and he will probably ring again.

MR. SEELEY—I would like to state to the Association that we have two exchanges in New York working multiple switch-boards, and we have none of the troubles here spoken of. Our operators work fifty-five drops, fifty subscribers, and five trunk wires. The average calls per operator are three to four hundred per day. We do not get up as high as a thousand for each operator. Of the subscribers who are the greatest users of the telephone an operator could not properly care for more than forty. The average is about fifty-five.

MR. LOCKWOOD—I would ask Mr. Seeley what method he has of communicating with subscribers, whether it is a branch or whether they loop in direct? How are the operators' telephones connected with subscribers' lines?

MR. SEELEY—They are looped in. Our operators have no trouble in talking with subscribers.

MR. CARTY—I would like to see if I understand the system in New York. Supposing a subscriber at Thirty-ninth street wants to call to Murray street. He calls up the operator at Thirty-ninth street, who rings on the trunk to Murray street and listens on that trunk until she gets an answer from Murray street. If three or four calls come in while she is waiting there, I want to know if she is obliged to neglect all those calls and listen on the line until she gets an answer from the Murray street office?

MR. SEELEY—Our subscribers call up the central office and give the number that is wanted to the operator, and immediately hang up their telephone and go away. The operator in turn, if a trunk connection is desired, calls up the operator in the second office, and remains there until she gets that operator, no matter what may happen in the

meantime, no matter if twenty annunciators fall down in the meantime. She gives the number called for to the operator in the second exchange, and the second exchange operator repeats back the number to the first exchange operator, so that there cannot be any possible mistake in understanding the number that is wanted. The operator must remain on that trunk wire until the number is repeated back to her, or lose the connection.

MR. CARTY—Now, while Thirty-ninth street is ringing Murray street, supposing Murray street commences ringing Thirty-ninth street, neither of the operators can leave their wires. Both of them must stay there forever.

MR. SEELEY—All of our trunk wires in the exchange do not go to one board or to one operator. We may have twenty trunk wires running between the two exchanges, and they run just the same as the subscribers' wires precisely. Every one is placed in front of each operator, and each operator has the use of any one of those twenty wires. If an operator at Murray street is waiting for a response from the Thirty-ninth street office, and the Thirty-ninth street office wants to get Murray street, if she cannot get them on one line she rings up on another wire. We have it so arranged that we have ten to send and ten to receive, and there can be no confusion between the wires. We work three systems in New York city. Those exchanges using the multiple boards have special trunk wires, and special trunk wire operators who have nothing to do but answer trunk calls. If an operator rings on a trunk wire she immediately gets an answer. There is no conflict whatever.

MR. CARTY—Between the two multiple exchanges, could not the case that I have supposed happen—that both operators would be ringing each other, one waiting for the other to answer?

MR. SEELEY—We have never had that experience. As I have before stated, we use two trunk wires, one to send a call on and one to receive a call on. If an operator in one of our "multiple" offices should be ringing the other mul-

tiple office, and the second office should ring her back, the two operators would assuredly have sense enough not to stand listening on two separate wires all day for an answer.

MR. CARTY—The reason I have taken up so much time in this questioning is that we have experienced trouble in just such cases, and I wanted to get information from Mr. Seeley. We have found that when an operator was waiting to get an answer from another office, it frequently happened that three or four calls came in which had to be neglected.

THE PRESIDENT—I would say that in our experience in Chicago we had exactly the same difficulty—that there was too much time lost by the operator at the first exchange waiting for the answer of the operator at the second, and when the second was "stuck," or slow, the result was that the first operator had to wait and lose time, and the subscriber had to wait and lose time, and other drops came down and remained unanswered. To remedy this difficulty we put the operation of repeating the call on the subscriber. We ring on the trunk line and allow the subscriber himself to repeat his order to the second office, whenever the second office operator answers. It works very satisfactorily indeed, and all our business is now done in that way. I think it reduces the work done by any operator to precisely the work done by an operator on a multiple board.

My object in provoking this discussion was to find out how accurately the number of connections made by an operator was given—how many connections were actually made by an operator in the course of a day. We have never been able in our method of watching and counting to make up such big records as are made by the other exchanges. Either we are mistaken or they are mistaken, or else the operators in Boston are smarter than those in Chicago. I am not prepared to believe there is so much difference in human nature. And it was with the sincerest desire to ascertain the facts that I asked Mr. Carty how that record was made up; and I did not get the information I wanted. Now I ask, how was the count made of the business done by the operator?

MR. CARTY—The count in Boston was made by the operators themselves.

THE PRESIDENT—We have always found that a thoroughly untrustworthy method. Operators will make a big record for themselves every time.

MR. CARTY—We have felt justified in making a large expenditure based upon just such figures, and the results we have obtained satisfy us. We have done it in the new office. We have not any reason to doubt that our operators have proved any more unreliable in the new office than in the old.

Mr. SUNNY—The count was made up with us under the immediate supervision of the chief operator. Most of the business is trunk line business. The operator at the office where the call originated puts down a mark on her tablet for a call that she sends on a trunk line. The operator at the distant office puts down a mark on her tablet for that call as she received it. In some instances those tablets were taken up every thirty minutes, and in other instances taken up every hour and a half, and I presume they were taken up in all offices eight times a day. The operators had no idea when those tablets would be taken up; so they could not compare notes with each other and agree upon a certain number of connections. Now as a check, to show the accuracy of the records kept by the operators, at the end of the day's work the calls sent and the calls received ought to balance one another; and they did balance one another within fifty. I think that as far as our records were concerned they were almost absolutely correct.

MR. METZGER—I suppose, as we are giving our various experiences, that something from Pittsburgh will be accepted. We have seven multiple boards—200 annunciators in each board. Each operator is expected to work eighty-five to ninety subscribers. When I received Mr. Carty's inquiry I reported that the highest number of calls made by an operator was about 750. The average is about 550—that is to say, an average number of from six to seven per subscriber. The count was obtained by the operator checking every call, and the records were collected every hour, and

then at the end of the day we footed it up. The next day we kept a record of all the connections— of every thing — the entire day's work, and we found it to balance within some fifty or sixty connections, or something like that; that is, they came out about the same We are using trunk wires—incoming and outgoing trunk wires. We have no trouble or delay. In trunk connections the system is a great improvement over the old system. We have some little trouble connected with our multiple board, which, I think, however, is only mechanical, and I have no doubt will be remedied by the manufacturers. On the whole, I think that the multiple board is a very great improvement over the Jones system, and we were very much in favor of the Jones system where we were using it. We thought it was a very rapid system, about as rapid as anything outside of the multiple or Law system that was in use. We find, however, quite a saving in the number of employees under the multiple system, and quite a difference in the loudness of the conversation. There is an improvement in that respect. We also find that subscribers are very much better pleased with branch line connections, because they are more rapid than under our old system. In fact, we cannot say anything but what is good and kind of the multiple system, as a big improvement. Of course, I think there is still room for improvements, but I have always found in the intercourse I have had with the manufacturers, that they have shown a disposition to make the necessary improvements or corrections that we require to be made.

MR. SEELEY—I would like to ask Mr. Carty what was the cost per wire of setting up the multiple switch-board in Boston?

MR. CARTY—I have not the figures with me; and besides, the expenses of setting up the board in Boston were so intimately connected with the expenses of getting out of the old office and getting into the new and fitting up the latter, that it was difficult to tell just where to draw the line. For that reason I have not gone into the figures at all, and am not prepared to state them.

THE PRESIDENT—I would like to ask Mr. Carty if he can give any probable suggestion as to the length of time required to make a connection in daily commercial use—taking all the time from the subscriber's first ring until he gets his party.

MR. CARTY—I never go into figures very much, and when you are dealing with seconds it is very misleading. But I know that subscribers will complain if they have to wait a minute, because I frequently receive complaints, and upon investigation find that the delay did not exceed one minute. But I could not tell you exactly what the time is. Some connections, and especially branch office connections, where you have to wait for a subscriber to answer, will take longer than others. I would not like to state just what the time is.

MR. EASTABROOK—The time is drawing near for that excursion down the bay. It is now nearly 12 o'clock. Mr. Lockwood is loaded up with information on the subject of the litigations of the past year. I know we all should like to hear him. I would like to ask the unanimous consent of the Convention that we should proceed to hear him.

MR. BOYD—Before you leave this subject it is only fair that I should say something in behalf of the Cumberland people, who have no one here to represent them. Their claim in regard to rapidity of working may seem pretty large, but there are some circumstances which may help to explain that. I cannot say of my own knowledge on what basis the report was made up, or whether it is correct. But the fact is, that their multiple board has some peculiarities of construction which I cannot explain, which render rapid work on it much easier than on some other boards. And then their subscribers have been educated up to the point of prompt answer to calls. Their subscribers answer more promptly than those in any other territory with which I am familiar. Then there is no "nursing." The connection is made, and is left.

MR. DURANT—Inasmuch as our time is very limited, I will suggest, if the paper assigned to Dr. Plush is here, that preference should be given to it over that on litigation.

THE PRESIDENT—The paper of Dr. Plush is not here. It was telegraphed for yesterday, but no reply has been received. A paper by Mr. Gilliland was announced upon the programme for this meeting. He says that owing to circumstances over which he had no control his paper was not completed in time to be read here to-day. But it will be published in such form that we all can get at it later.

Mr. T. D. Lockwood then spoke as follows on the subject of "Litigation:"

MR. LOCKWOOD—There is very little new to say upon this subject. What little there is, is favorable. Two years ago I had the honor and pleasure of commenting at some length upon the existing state of litigation upon telephone patents. It was then thought advisable to listen to those comments in executive session. I think that I may congratulate the Association upon the fact that such a precaution is no longer necessary. The Bell Telephone patent, after a prolonged litigation, such as no other patent was ever subjected to, has been triumphantly vindicated. In the year which has passed since we last met as an Association there has, perhaps, been a larger number of telephone decisions rendered in Court than in any other preceding year of our existence. The great suit between the American Bell Telephone Company and the People's Telephone Company is now a matter of history. So far as Circuit Courts are concerned, the decision in that case was all that we could have desired. That suit was not altogether an unmitigated evil, in that it gave Judge Wallace a telephonic education only second to that possessed by our own people. Under the hands of that eminent teacher Mr. Storrow, he acquired a great store of knowledge, which came into use later. That was the greatest decision. That established the validity of the Bell patent over the most unscrupulous competitor. An injunction was also obtained against the McDonough Telephone Company, also against the Molecular Telephone Company, which sought to operate under the patents of Lockwood & Bartlett. In Cleveland, where there was a branch of this company, they declined to abide by the

New York decision, and a separate suit was necessary. This was decided by Stanley Mathews in person. The Clay Telephone Company, of Philadelphia, has also been enjoined. The Overland Company, which has been very obnoxious, and which under the ruling of Judge McKinney, of Philadelphia, was allowed a new lease of life until the Drawbaugh suit was decided, has also been closed up by an injunction. The case against the Overland people had several branches. But the most notable victory was at Utica. The Overland Company there put in the claim that they ought to be exempted from injunction in consideration of giving bonds for such damages as might be assessed in the event of an ultimate Supreme Court decision in favor of the Bell Company. Judge Wallace decided that on the ground that while that infringement was going on, damage would ensue to the Bell Company, which was quite true. Injunction was given there.

The other principal suit was that in Pittsburgh, where the so-called Western Pennsylvania Company, a licensee of the National, was working death and destruction to our friend Mr. Metzger. That was a bitterly fought suit. The opposition had very high hopes, went there with a strong high hand, and were going to be a pillar against the existing despotism.

THE PRESIDENT—What telephone did they use?

MR. LOCKWOOD—They used a Randall transmitter. It was really nothing else but a modification of the Blake transmitter. The receiver was nothing more than a magneto telephone, with some little variation in form. This company had a little more "cheek" than most of them, and commenced a counter-suit against the Bell Telephone Company for infringing their patents, which is now being proceeded with, and will be dealt with in the usual way, I doubt not. A decision was also obtained, after three days' argument, however. After hearing the arguments of our counsel, and a portion of those of the opposing counsel, and hearing that there were many new arguments to be presented, the Judge shut them up summarily, and said he could not listen to any more at present.

In view of the well known comity existing in Circuit Courts, we have nothing more to fear from Circuit Court decisions. Of the recently organized infringing companies, the most important one is the Pan Electric, which is operating, as they claim, under the patents of Rogers. This company and the National Improved are very much alike, and dispute somewhat as to the ownership of the Rogers' patents. They have had a little fight of their own going on, while fighting us also. They moreover had the assurance to bring a suit in New Orleans, and one in Memphis, upon the usual grounds, the non-inventorship of Mr. Bell, the prior inventorship of Mr. Reiss, etc., etc. In the Patent Office the long pending interference to determine the inventorship of the telephone in all its bearings has finally been decided, after two appeals on behalf of Mr. Bell. I should say here that when I last spoke to you on this subject, the main points were decided in favor of Mr. Bell. But the point covering the magneto receivers was in favor of Mr. McDonough. I expressed the opinion then that the latter would be reversed upon appeal, and my prediction has proved a true one. We appealed to the Board of examiners-in-chief, and that Board awarded priority to Mr. Bell upon all the important points, and to Edison upon others. The McDonough people then appealed to Commissioner Butterworth, in person, and he decided in favor of Bell on all grounds most frankly and decidedly. I have to congratulate the Association upon the remarkably clear horizon at present. The Dolbear Company has appealed against the decision of the Supreme Court (Justice Gray), and the ultimate decision of Judge Lowell in favor of Bell, as against Dolbear, which will probably be heard next spring. That is about all there is to say.

MR. EASTABROOK—I would like to ask if the People's Telephone Company have taken any action in the way of appeal.

MR. LOCKWOOD—So far as I know, no; I don't think they have as yet. They have taken some steps to protect their company from paying damages for what it has already done.

THE PRESIDENT—Are there any further questions to be asked Mr. Lockwood?

I will take this occasion to make the announcement on behalf of Mr. Duxbury, of the Providence Telephone Company, that the excursion boat will be ready at 1 o'clock. I would add that the Providence Company have invited a number of the leading people here to meet us on the boat; and I trust that a full representation of the Association will acknowledge the courtesy of the invitation by their presence. Five o'clock is fixed as the hour for the return of the boat to this city.

MR. SUNNY—I move that the thanks of the Association be given to the Providence Telephone Company and to the Committee of Arrangements, Gov. Howard, Gen. Barney, Messrs. J. W. Duxbury and A. C. White, and last, but not least, Mr. Eugene F. Philips, for the hospitable manner in which we have been entertained.

The resolution was adopted unanimously.

MR. WILSON (of Baltimore)—I move that the thanks of this Association be tendered to the press of this city for the very full and satisfactory reports of the proceedings of this meeting.

The motion was unanimously adopted.

THE SECRETARY—Before we separate officially I would like to make two or three announcements. The first is rather a request than announcement. If there are any delegates present who have not given me their names, I request them to do so now, so that they may appear in the printed report. There have been several new arrivals to-day. Some of them I have noticed and have taken their names, but there are probably some whom I have not seen, and I would be glad to get the names of all.

The second announcement is to those members who came on the boat from New York Monday night, and who expect to return by the same route. They should understand that the state rooms occupied on the trip from New York were only reserved for that trip; that the boat going back on Friday night will be the *other* boat of the line, and that it is

advisable to look after the securing of their state rooms in advance. State rooms may be secured at No. 1 Weybosset street, about a block from this hotel.

The third announcement is that the ex-Secretary has turned over to me a few copies of the proceedings of last year's meeting at Philadelphia. If any of the members are not supplied, or desire extra copies, they can procure them from me at the fixed price of $1.25

MR. DURANT—I wish to offer a suggestion. I think that some, if not a number, of the companies will be met during the next winter by new legislation in the direction of compulsory underground lines. As the papers read upon that question here would afford considerable ammunition to an attorney as the basis for arguments, it seems to me that an extra number of copies of papers relating to that subject should be printed aside from the regular report of the Convention. If the members agree with me, I think a resolution to that effect would be very proper.

THE PRESIDENT—In the Executive Committee this question was talked over, and it was thought that a list of various kinds of information, both such as are contained in these papers and statistical information, should be compiled by the Executive Committee and furnished to the Secretary, who thereupon will receive from all quarters information on those subjects, have it printed and transmitted to the various members of the Association as a regular thing.

MR. METZGER—When was that action taken by the Executive Committee?

THE PRESIDENT—There was no action on it. We talked of it yesterday while sitting here on the sofa. You were present, were you not?

MR. METZGER—I understood that the Secretary was to compile it.

THE PRESIDENT—I should have said that the Secretary, under the direction of the Executive Committee, was to do the work, and the Executive Committee were to lay out, as I understood it, a scheme of the work to be done.

MR. DURANT—In that connection I would also suggest that those who can, do so, secure copies of the pamphlets, to be

found on the table, relating to the Pennsylvania case, and that as many of these copies as can be had shall be placed in the Secretary's hands, so that they may be available in emergency for those who need them. There are quite a number of pamphlets, especially legal arguments. I shall be very glad to have them, for one, if they are for general distribution.

THE PRESIDENT—We shall need a considerable supply of that kind of ammunition, and it ought to be in the hands of the Secretary, ready at command, when it can be had.

MR. METZGER—Before we adjourn I desire to tender the hospitalities of the city of Pittsburgh for the annual Convention that will be likely to be held in 1887. I intended to present this offer to the Convention for the next meeting, but understanding that St. Louis had had the promise of the annual meeting for 1886, why, of course, I waived it. I now present the claims of the city of Pittsburgh. I hope to show the members of the Association a very different city from any they have ever seen before, and I think fully as clean as the other cities in the United States.

MR. DURANT—I would like to ask, while it is upon my mind, whether it is expected that the paper of Dr. Plush will be put in the hands of the Secretary for publication.

THE PRESIDENT—If no objection is made, the Secretary will consider himself instructed to obtain Dr. Plush's paper, if possible, for publication.*

MR. SUNNY—I move that we now adjourn.

MR. SARGENT—I second the motion.

THE PRESIDENT—It is moved and seconded that this meeting of the Association finally adjourn. Those in favor will signify their assent by saying "aye." Those opposed, "no." The ayes have it, and the meeting is adjourned *sine die*. The next meeting of the Association will be held at St. Louis on the first Tuesday of September, (September 7th) 1886.

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* NOTE—The Secretary has corresponded with Dr. Plush, and endeavored to obtain his paper, but the Doctor in his last letter states that he has been unable to prepare it as requested.

The following letter from Monsieur A. Berthon, of Paris, who was last year elected an honorary member of the Association, was received after the final adjournment at Providence. [Secretary.]

STEAMER GONDOLIER,
CALEDONIAN CANAL,
September 1st, 1885.

MR. SARGENT, *Secretary to the National Telephone Association, Providence,*

DEAR SIR—This summer we are traveling in England, Ireland and Scotland.

Having just reminded myself that the annual meeting of the National Telephone Association has to be held in Providence on the 10th of this month, I take this opportunity to acknowlege the receipt of the documents of the Convention, which I got in due time, and send you the very few news, which may be given concerning the telephone business in France, as scarcely no change has occurred since last year.

The increase of subscribers for Paris during the past year has been of about 700. I must mention as an accommodation to subscribers the opening this year of about 80 public telephones in the branch post offices of Paris, the fare for five minutes' talk being 10 cents. An annual payment of $8, or of $4, if you are a subscriber to the exchange, gives you the right to communicate through any public telephone. We have also fitted up a small exchange at the central telegraph office in Paris, to enable our subscribers to send or receive telegraph messages at their offices. We charge $10 per annum for such accommodation, not including the telegram taxes.

You have seen by the newspapers, no doubt, that our company (The Société Générale des Téléphone) has encountered much difficulty in renewing with the municipality of Paris, for a new period of five years, the concession by which it was authorized to lay telephone cables in the sewers. Finally the matter has been settled by paying to the municipality the same duty of 10 per cent. of the gross receipts the company pays to the Government.

This right excluding all idea of a monopoly for the existing company, similar right might be given to any other competing company.

The company is also bound to connect by trunk lines (half the expense of construction of these being at its charge) the existing plant with the competing one.

But the company, considering that by such a condition the municipality has exceeded her powers, the case is now deferred to the Government, and the matter is pending.

In fact, we do not think that it should be possible for any other company to compete with us at lower rates, though they profess to be able to rent their instruments and underground lines at the rate of $73 per annum instead of $120, our own rate. We feel perfectly quiet on that point, but it has been for the last six months preventing subscribers to renew their contracts and preventing people to become subscribers. We have put in use for trial several useful improvements, concerning instruments and telephone circuits. The direct call, system which I described last year, is worked quite satisfactorily on a certain

number of lines connected, either one or two exchanges, reducing consequently much of the business of the exchanges. Very good results have been obtained from the use of the double carbon vibrating plate transmitter, with loose carbon grains between both in a small cup attached to the bottom plate. The Von Rysselberghe system, for the use simultaneously of telegraph wires for telephoning, has been tried successfully between Rouen and Havre, about fifty miles.

It is used to a greater extent between towns in Belgium. The results are practically good, but induction is never entirely destroyed, and the talking is weakened. I must now conclude, having exhausted the subject telephone.

Will you kindly remember me to the members of the Association, expressing to them at the same time my regrets of not being able to attend this year the Convention, and believe me, dear sir,

Very truly yours,

A. BERTHON,

Ingénieur Directeur de la Construction et de l'Exploitation de la Société Générale des Telephones, 41 Rue Caumartin, Paris.

APPENDIX A.

OFFICERS FOR THE YEAR 1885–1886.

President,

C. N. FAY, - - - - - - - Chicago, Ills.

Vice-President,

GEO. F. DURANT, - - - - St. Louis, Mo.

Secretary,

C. H. BARNEY, - - - - - New York, N. Y.

Treasurer,

H. L. STORKE, - - - - New York, N. Y.

Advisory Committee,

For three years—MORRIS F. TYLER, New Haven, Conn.
For two years—W. A. JACKSON, Detroit, Mich.
For one year—B. E. SUNNY, Chicago, Ill.

Executive Committee.

C. N. FAY, *Ex-officio,* - - - - Chicago, Ills.
JAMES BIGLER, - - - - Newburgh, N. Y.
HENRY METZGER, - - - Pittsburgh, Pa.
C. F. CUTLER, - - - - - New York, N. Y.
R. M. BAILEY, - - - - Williamsport, Pa.

APPENDIX B.

ROLL OF ACTIVE MEMBERS.

SEPTEMBER 10, 1885.

American District Telegraph Co., Syracuse, N. Y.
American Telephone & Telegraph Co., New York City.
Bell Telephone Co. of Buffalo, Buffalo, N. Y.
Bell Telephone Co. of Missouri, St. Louis, Mo.
Bell Telephone Co. of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Chicago Telephone Co., Chicago, Ills.
City & Suburban Telegraph Association, Cincinnati, O.
Colorado Telephone Co., Denver, Col.
Central Union Telephone Co., Chicago, Ills.
Cumberland Telephone & Telegraph Co., Nashville, Tenn.
Chesapeake & Potomac Telephone Co., Washington, D. C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
East Tennessee Telephone Co., New York City.
Empire State Telephone & Telegraph Co. Auburn, N. Y.
Erie Telephone & Telegraph Co., Boston, Mass.
Great Southern Telephone & Telegraph Co., Nashville, Tenn.
Hudson River Telephone Co., New York City.
Iowa Union Telephone & Telegraph Co., Davenport, Iowa.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.

New York & New Jersey Telephone Co., Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York.
New England Telephone & Telegraph Co., Boston, Mass.
Ohio Valley Telephone Co., Louisville, Ky.
Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburgh, Pa.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven, Conn.
Sunset Telephone & Telegraph Co., San Francisco, Cal.
United Telephone Co., Kansas City, Mo.
Wisconsin Telephone Co., Milwaukee, Wis.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Boston, Mass.
Bell Telephone Co., Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, George L., Chicago, Ills,
Bailey, C. E., Havana, Cuba.
Berthon, A., Paris, France.
Callender Insulating and Water-proofing Co., New York City.
Childs, W. A., New York.
Cheever, Charles A., New York.
Cassidy, John, Honolulu.
Clark Insulated Electric Wire Co., Philadelphia, Pa.
Dana, P. H., New York.
Day, A. G., New York.
Electrical Supply Co., New York.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington.
Madden, O. E., Boston, Mass.
McConnell, J. T., Pittsburgh. Pa.
Phillips, George L., Dayton, O.
Phillips, E. F., Providence, R. I.
Potter, F. I., Pittsfield, Mass.

Pope, H. W., New York.
Palmer Wire Co., Palmer, Mass.
Roebling's Sons, J. A., New York.
Sawyer, W. H., Providence.
See, I. W., Cincinnati, O.
Standard Electrical Works, Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., Boston, Mass.
Williams, Jr., Charles, Boston, Mass.
Western Electric Co., Chicago, Ills.
Wiley. George L., New York City.

APPENDIX C.

CONSTITUTION.

ARTICLE I.—NAME.

The name of this Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual, but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, provided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and an Advisory Committee; who shall, with the exception of the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—Vice-President.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—Secretary.

The Secretary shall keep a record of the proceedings of all meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—Treasurer.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—Executive Committee.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Secretary and transmit to the Association all applications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting, and the action of this Committee shall not be final, but advisory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—Advisory Committee.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws, as in their opinion will best further the aims and purposes of the Association.

3. The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, affecting telephone interests, and shall report thereon to the Association with such recommendations as it may deem advisable.

4. It may also consider any question touching the interests of the members of this Association that may be referred to it, and may call for papers or other

documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, so far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committee which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other person, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands, beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. There shall be an annual meeting of the Association held on the first Tuesday after the first Monday of September in each year, at such place as may be determined by the Association, or upon its failure to designate a place for such meeting, the Executive Committee may make such selection at least sixty days previous to the time of holding said annual meeting.

2. Special meetings of this Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the Constitution. The annual dues shall be ten dollars for each vote now had or that may be hereafter acquired under the Constitution, and shall be payable yearly on or before the first day of July in each year.

2. The Association may, by resolution and majority vote of the members present, make an assessment for any purpose in addition to above provisions.

ARTICLE XV.—Expulsion.

Any member may be suspended or expelled for misconduct, or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—Amendments.

This Constitution shall go into effect immediately. It shall be amended only by a two-thirds vote of the members present at a meeting of the Association, after the notice of the proposed amendments.

ARTICLE XVII.—Honorary Membership.

1. Any person actively interested in the objects of this Association may become an honorary member of the Association by the vote of a majority of all the members represented at such meeting, and the payment of an entrance fee of twenty-five dollars.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

APPENDIX D.

AMENDMENTS.

CONSTITUTION.

Adopted at the Chicago Meeting, April, 1881.

I.

ART. XIV. SEC. 2. The Association may, by resolution adopted by a majority of all the votes of the Association, make assessments on the members thereof, and such assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

II.

ART. XVI. SEC. 1. This Constitution shall go into effect immediately.

SEC. 2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

SEC. 3. Notice of such proposed change shall be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post-office address of each member.

Adopted at the Boston Meeting, September, 1882.

III.

ART. XIII. SEC. 1. There shall be an annual meeting of the Association held on the third Tuesday in October in each year, at such place as may be determined by the Association, or upon its failure to designate a place for such meeting, the Executive Committee may make such selection at least sixty days previous to the time of the holding of said annual meeting.

At the Cincinnati Meeting, October, 1883.

Amendment III. was formally nullified, having been irregularly passed.

Adopted at the Philadelphia Meeting, September 16, 1884.

IV.

ART. XIII. "That the Association at its annual meetings, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting."

APPENDIX E.

BY-LAWS.

ARTICLE I.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—PRESIDENT.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—SECRETARY.

§ 1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

§ 2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the object for which they are called; and shall keep correctly the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

§ 3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

§ 4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipt and disposal upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

ARTICLE IV.—TREASURER.

§ 1. The Treasurer shall keep an accurate roll of the members, and shall collect, under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

§ 2. Shall keep regular books of accounts, which shall be open to inspection by any member of the Executive Committee.

§ 3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

§ 4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—COMMITTEES.

§ 1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of this Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said committee, who will, in case it is not deemed expedient to hold a meeting of said committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report with the Secretary.

§ 2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this Committee.

ARTICLE VI.—MEMBERSHIP.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of the Board of its Directors, make application for membership, and shall forward a copy of such proceedings, properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition, when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—NON-PAYMENT OF DUES.

If any member fails to pay the yearly dues or assessments within one month from the first day of July, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that unless the same are paid within one month thereafter, the default will be reported to the Executive Committee, which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues

to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—AMENDMENTS.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting, provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—SUSPENSION OF RULES.

These rules may be suspended at any meeting of the Association by a majority of all the votes represented at such meeting.

Amendment to By-Laws adopted at Philadelphia, Sept. 16, 1884.

ART. X. "At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be *ex-officio* chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require."

APPENDIX F.

THE STANDARD WIRE GAUGE.

Adopted by the National Telephone Exchange Association, September 8, 1885.

(New English Board of Trade, Standard Wire Gauge, Legalized March 1, 1884.)

Table of Dimensions, Weights and Resistances of Copper and Iron Wire.

Compiled by C. H. Barney, Secretary of the National Telephone Exchange Association.

Number of Standard Gauge.	Diameter.		Pure Copper Wire.				Galvanized Iron Wire.			Number of Standard Gauge.
	In Mils. (.001 in.)	In Millemetres.	Weight, Sp. Gr., 8.90.		Resistance at 59.9° Fah.		Weight, Sp. Gr., 7.74. Lbs. per Mile.	Resistance, at 59.9° Fah.		
			Lbs. per 1,000 feet.	Lbs. per Mile.	Ohms per 1,000 feet.	Ohms per Mile.		Ohms per Mile.		
7-0	500	12.700	756.28	.....	.....	.....	.....	.....	.....	7-0
6-0	464	11.785	651.31	.....	.....	.....	.....	.....	.....	6-0
5-0	432	10.973	564.44	.....	.....	.....	.....	.....	.....	5-0
4-0	400	10.160	484.03	.....	.....	.....	.....	.....	.....	4-0
3-0	372	9.449	418.63	.....	.....	.....	.....	.....	.....	3-0
2-0	348	8.839	366.36	.....	.....	.....	.....	.....	.....	2-0
0	324	8.229	317.54	1676.61	.095774	.50558	.....	.....	.....	0
1	300	7.620	272.27	1437.58	.11171	.58982	.....	.....	.....	1
2	276	7.010	230.44	1216.72	.13199	.69690	.....	.....	.....	2
3	252	6.401	192.11	1014.34	.15832	.83592	.....	.....	.....	3
4	232	5.893	162.83	859.74	.18680	.98630	747.68	6.6884		4
5	212	5.385	135.96	717.87	.22370	1.18113	624.30	8.0100		5
6	192	4.877	111.52	588.82	.27273	1.4400	572.07	9.7656		6
7	176	4.470	93.71	494.78	.32458	1.7137	430.29	11.6222		7
8	160	4.064	77.445	408.89	.39273	2.0736	355.60	14.0625		8
9	144	3.658	62.730	331.21	.48486	2.5600	279 34	17.3611		9
10	128	3.251	49.565	261.70	.61365	3.2400	227.59	21.9726		10
11	116	2 946	40.707	214.93	.74718	3.9451	186.92	26.7539		11
12	104	2.642	32.720	172.76	.92955	4.9080	150.24	33.2840		12
13	92	2.337	25.605	135.19	1.1878	6.2715	117.57	42.5331		13
14	80	2.032	19.361	102.22	1.5709	8.2943	88.90	56.2500		14
15	72	1.829	15.688	82.80	1.9394	10.2400	72.01	69.4444		15
16	64	1.626	12.391	65.42	2.4546	12.9602	56.89	87.8906		16
17	56	1.422	9.4869	.....	3.2060	.....	.....	.....	.....	17
18	48	1.219	6.9700	.....	4.3637	.....	.....	.....	.....	18
19	40	1.016	4.8408	.....	6.2837	.....	.....	.....	.....	19
20	36	0.914	3.9206	.....	7.7577	.....	.....	.....	.....	20
21	32	.813	3.0978	.....	9.8184	.....	.....	.....	.....	21
22	28	.711	2.3708	.....	12.824	.....	.....	.....	.....	22
23	24	.610	1.7425	.....	17.455	.....	.....	.....	.....	23
24	22	.559	1.4642	.....	20.773	.....	.....	.....	.....	24
25	20	.508	1.2100	.....	25.135	.....	.....	.....	.....	25
26	18	.457	0.98015	.....	31.031	.....	.....	.....	.....	26
27	16.4	.4166	.81365	.....	37.381	.....	.....	.....	.....	27
28	14.8	.3759	.66263	.....	45.90	.....	.....	.....	.....	28
29	13.6	.3454	.55953	.....	54.358	.....	.....	.....	.....	29
30	12.4	.3150	.46515	.....	65.388	.....	.....	.....	.....	30
31	11.6	.2946	.40707	.....	74.718	.....	.....	.....	.....	31
32	10.8	.2743	.35286	.....	86.197	.....	.....	.....	.....	32
33	10.0	.2540	.30252	.....	100.541	.....	.....	.....	.....	33
34	9.2	.2337	.25605	.....	118.79	.....	.....	.....	.....	34
35	8.4	.2134	.21346	.....	142.49	.....	.....	.....	.....	35
36	7.6	.1930	.17473	.....	174.07	.....	.....	.....	.....	36
37	6.8	.1727	.13988	.....	216.94	.....	.....	.....	.....	37
38	6.0	.1524	.10891	.....	279.28	.....	.....	.....	.....	38
39	5.2	.1321	.08180	.....	371.82	.....	.....	.....	.....	39
40	4.8	.1220	.06970	.....	436.37	.....	.....	.....	.....	40

The resistances in the above table are calculated from Dr. Matthiessen's standard (1 mile of pure copper wire of 1-16 inch diameter equals 13.59 ohms at 59.9° Fahr.)

The resistance of pure copper wire increases as the temperature rises, about 0.21 per cent. for each additional degree F.

The resistance of iron wire increases as the temperature rises, about 0.35 per cent.

APPENDIX G.

Table showing the difference between Wire Gauges in decimals of inches.

No.	Standard. (New British.)	B. W. G.	Brown & Sharpe's	Washburn & Moen's.
4–0	.400	.454	.460	.393
3–0	.372	.425	.40964	.362
2–0	.348	.380	.36480	.331
0	.324	.340	.32495	.307
1	.300	.300	.28930	.283
2	.276	.284	.25763	.263
3	.252	.259	.22942	.244
4	.232	.238	.20431	.225
5	.212	.220	.18194	.207
6	.192	.203	.16202	.192
7	.176	.180	.14428	.177
8	.160	.165	.12849	.162
9	.144	.148	.11443	.148
10	.128	.134	.10189	.135
11	.116	.120	.09074	.120
12	.104	.109	.08081	.105
13	.092	.095	.07196	.092
14	.080	.083	.06408	.080
15	.072	.072	.05706	.072
16	.064	.065	.05082	.063
17	.056	.058	.04525	....
18	.048	.049	.04030	....
19	.040	.042	.03589	....
20	.036	.035	.03196	....
21	.032	.032	.02846	....
22	.028	.028	.025347	....
23	.024	.025	.022571	....
24	.022	.022	.0201	....
25	.020	.020	.0179	....
26	.018	.018	.01594	....
27	.0164	.016	.014195	....
28	.0148	.014	.012641	....
29	.0136	.013	.011257	....
30	.0124	.012	.010025	....
31	.0116	.010	.008928	....
32	.0108	.009	.00795	...
33	.0100	.008	.00708	....
34	.0092	.007	.0063	....
35	.0084	.005	.00561	....
36	.0076	.004	.005	....
37	.0068	.....	.00445	....
38	.0060	.....	.003965	....
39	.0052	.....	.003531	....
40	.0048	.....	.003144	...

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EIGHTH ANNUAL MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

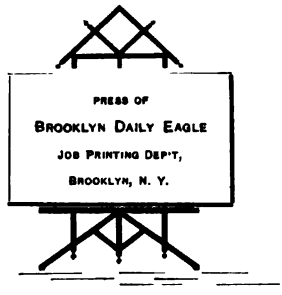
ASSOCIATION,

HELD AT

THE SOUTHERN HOTEL, ST. LOUIS, MO.,

September 7th, 8th and 9th, 1886.

1886.


PRESS OF
BROOKLYN DAILY EAGLE
JOB PRINTING DEP'T,
BROOKLYN, N. Y.

EIGHTH ANNUAL MEETING

OF THE

National Telephone Exchange Association

HELD AT THE

SOUTHERN HOTEL, ST. LOUIS, MO.

SEPTEMBER 7th, 8th and 9th, 1886.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11 A. M., the President, C. N. Fay, of Chicago, in the chair, and C. H. Barney, of New York, Secretary.

THE PRESIDENT—The Association will come to order. I believe that Mr. Durant, of the St. Louis Company, and the Vice-President of the Association, has an invitation to tender us, which it is well to receive now. Is Mr. Durant present?

MR. DURANT—*Mr. President, and Gentlemen of the Convention*, on behalf of the Bell Telephone Company of Missouri, I bid you a most hearty welcome, and desire to say that we have arranged for a steamboat excursion; the boat to leave the foot of Elm street at two o'clock to-morrow afternoon, for a trip to Crystal City, about thirty miles down

the river. If it is the pleasure of those who participate in the excursion to land and witness the operation of the manufacture of plate plass, they may do so. You will also have an opportunity to get an excellent view of our bridge here, just before we pass down the river.

I also wish to say that the hotel is without a telephone, but you will find in the rooms of the American Bell Company, room 42, a telephone connected with our exchange, which you are welcome to use.

We hope you will visit our central office as many times as you wish. We have something that is entirely new, and which I wish to call your particular attention to—that is, a cross-connecting board on a novel plan, which we think is a most valuable thing.

THE PRESIDENT—You hear Mr. Durant's invitation. The Mississippi river is well known not to be salt. Is there any gentleman who has any motion to offer in reference to the invitation to go up the river or down the river to-morrow? What is your pleasure with it, gentlemen?

MR. GIFFORD—I move that we return our thanks to Mr. Durant for his very kindly expressions of welcome, and that we accept his invitation.

The motion was carried.

THE PRESIDENT—The next business is the calling of the roll. The Secretary will call the roll. The Secretary requests that representatives of members, and associate members of the Association, will be kind enough to hand their cards to him in order that a complete roster of names may be made.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session.

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH CO., New York City.—Edward J. Hall, Jr., General Manager.

BELL TELEPHONE CO. OF BUFEALO., Buffalo, N. Y.—Edward J. Hall, Vice-President; Harlow C. Palmer, Secretary and Treasurer.

BELL TELEPHONE CO. OF MISSOURI, St. Louis, Mo.—E. A. Hitchcock, President; George F. Durant, General Manager; E. A. Smith, Secretary; J. F. Taubold, Superintendent.

CENTRAL DISTRICT AND PRINTING TELEGRAPH CO., Pittsburgh, Penn.—Henry Metzger, General Manager; M. R. Wolff, Superintendent.

CENTRAL PENNSYLVANIA TELEPHONE AND SUPPLY CO., Williamsport, Penn.—R. M. Bailey, General Manager.

CHICAGO TELEPHONE CO., Chicago, Ill.—C. N. Fay, Vice-President and General Manager.

COLORADO TELEPHONE CO., Denver, Col.—E. B. Field, General Manager.

CENTRAL NEW YORK TELEPHONE AND TELEGRAPH CO.—H. L. Storke, President.

EAST TENNESSEE TELEPHONE CO., New York City.—D. I. Carson, Secretary.

EMPIRE STATE TELEPHONE AND TELEGRAPH CO., Auburn, N. Y.—H. L. Storke, President.

ERIE TELEPHONE AND TELEGRAPH CO., Lowell, Mass.—James W. Bennett, President; Charles J. Glidden, Treasurer; J. P. McKinstry, General Manager; J. K. Dunbar, Superintendent Southwestern Division.

HUDSON RIVER TELEPHONE CO., New York City.—H. L. Storke, Treasurer; A. B. Uline, General Manager.

METROPOLITAN TELEPHONE AND TELEGRAPH CO., New York City.—J. K. Seeley, Electrician.

MISSOURI AND KANSAS TELEPHONE CO., Kansas City, Mo.—J. R. Mulvane, President; C. D. Crandall, Secretary and Treasurer; Wiley W. Smith, General Superintendent; Chas. W. McDaniel, Superintendent.

NEBRASKA TELEPHONE CO., Omaha, Neb.—J. J. Dickey, Vice-President; Flemon Drake, General Manager.

NEW YORK AND NEW JERSEY TELEPHONE CO., Brooklyn, N. Y.—Wm. D. Sargent, General Manager.

NEW YORK AND PENNSYLVANIA TELEPHONE CO., New York City.—W. N. Eastabrook, General Manager.

NEW ENGLAND TELEPHONE AND TELEGRAPH CO., Boston, Mass.—J. N. Keller, General Manager.

OHIO VALLEY TELEPHONE CO., Louisville, Ky.—H. N. Gifford, General Manager.

PENNSYLVANIA TELEPHONE COMPANY, Harrisburgh, Penn.—J. B. Ker, General Manager.

ROCKY MOUNTAIN BELL TELEPHONE CO., Salt Lake City, Utah.—C. F. Aunett, President and General Manager.

SOUTHERN BELL TELEPHONE AND TELEGRAPH CO., New York City.—D. I. Carson, General Superintendent.

SOUTHERN NEW ENGLAND TELEPHONE CO., New Haven, Conn.—H. P. Frost, General Manager.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE CO., Boston, Mass.—C. Jay French, Assistant General Manager; Thos. D. Lockwood, Electrician; Thomas B. Doolittle, Robert S. Boyd, J. M. Brown, Frank B. Knight, Special Agents; Albert O. Morgan, Wm. A. Hovey, George Albree.

BELL TELEPHONE CO., of Canada, Montreal.—Charles P. Sclater, Secretary and Treasurer.

BRIDGEPORT BRASS CO., of Bridgeport, Conn.—Henry D. Stanley.

BEETLE, GEORGE L., New York City.

CHILDS. WM. A., New York City. (Also represented by Frank Shaw.)

CHEEVER, CHARLES A., New York City, by George T. Manson.

DAY, A. G., New York City, by Clark B. Hotchkiss.

LOCKWOOD, THOMAS D., Boston, Mass.

PHILLIPS, E. F., Providence, R. I., by George F. Beetle.

STANDARD ELECTRICAL WORKS, Cincinnati, O.—E. V. Cherry, Vice-President; H. T. Crane.

WESTERN ELECTRIC CO., Chicago, Ill.—J. M. Jackson, Secretary; C. A. Brown, W. R. Patterson, F. W. Harrington.

MR. DRAKE—I would like to propose the Rocky Mountain Bell Telephone Company for active membership.

THE PRESIDENT—There is an opportunity afforded under the rules at present for the nomination of new members, such nominations to be taken up and acted on later. If there are any other nominations the Chair will receive them now.

MR. DRAKE—Will it be considered that the Rocky Mountain Telephone Company has been nominated?

THE PRESIDENT—Yes, sir.

The President then delivered the following address:

ADDRESS OF THE PRESIDENT.

GENTLEMEN—It gives me great pleasure to call to order the Eighth Annual Meeting of the National Telephone Exchange Association, and to wish for it and its members happiness and prosperity during the coming year. The outlook for general business is magnificent. Trade and labor troubles seem wellnigh ended. The triumph of the law over Anarchy and Socialism has been so heartily welcomed by the mass of our people, that all men feel confident that these poisonous exotics have no firm root in American soil. This confidence has already been reflected in the unloosing of capital, and the starting of the wheels of trade. Small stocks coupled with low prices of all staples, a sound financial condition of the public treasury and of general business, sufficient crops, an active foreign demand for our exports, all point to an era of commercial prosperity and activity. The telephone companies of the country are prepared to

take advantage of this. The past year has been a trying one. The city companies have to face enormous expense for underground lines. The companies doing country business have been compelled to carry out still further the process of closing and abandoning exchanges which have proved too small for self-support. City and country exchanges alike have suffered from legislative and municipal attacks upon their rates, and the whole business has been disturbed and unsettled by the Government attacks on the Bell patents. Nevertheless, the upshot of it all is, that the American Bell Company and ourselves, the licensee companies, are still alive, still doing business, and we hope to grow in size and usefulness, strength and popularity, as time goes on.

It is unquestionable that a wave of popular hostility, which some one has named telephomania, has swept over the country, directed against the telephone, perhaps because it is the most visible and tangible, and everywhere localized of all monopolies. It is worth while to inquire with what justice we are thus attacked. Is it true that enormous fortunes have been made by franchises corruptly obtained, by stock waterings, and, to use the current phrase, by oppressing the people?

Let us look broadly at the facts. The capital stock of the American Bell Company is $10,000,000, now selling in the market for $19,000,000. Of this amount the shareholders actually paid into the Company's treasury in cash $6,000,000, showing their profit to date to be $13,000,000. The licensee companies throughout the country are capitalized at about $54,000,000, selling in the market to-day for not to exceed $25,000,000, an amount considerably below the actual money paid therefor, and below the actual cost of the plant and acquired business. There are undoubtedly individuals, who, in the manipulation of telephone stocks, purchases and sales thereof, have made and retained considerable fortunes, but the broad fact remains that, say, $15,000,000 would cover the entire amount of profit which the telephone fraternity have been enabled to extract from the suffering people during ten years of hard work, adding to their investment of $30,000,000 of capital, say five per cent. per annum. On the basis of the last census this would be three cents per annum extorted from each of the suffering people aforesaid. As I look around this room and view this assemblage of "monopolists" and "extortionists" I do not see a single millionaire. I doubt if all of us together could muster that sum. I challenge the investigation of the industrial history of this generation to show an instance in any line of trade in which so large a business has been developed upon so small a margin of profit. Fortunes abound on every hand made in railroads, mills, mines, manufactories, breweries, groceries, dry-goods stores, and the like; and as for *patents*, the individual fortune of Mr. Singer, of the Singer Sewing Machine, exceeded the entire profit of the telephone men, as did that of Mr. McCormick, of the McCormick Reaper Works, but no one grumbles; the unlucky telephone is made the scapegoat for the whole.

Another noteworthy fact is that the great mass of the people have in the nature of things nothing whatever to do with the telephone. With the time and expenditure aforesaid we have managed to put in use, say, 160,000 sets of telephones; that is, we have reached one-fourth of one per cent. of the population of the country (in our wildest dreams we cannot hope to reach more than one-half

of one per cent.), and this minute fraction of the population is most emphatically, in every way, shape and manner, composed of the rich capitalist class. Telephone users are men whose business is so extended and whose time is so valuable as to demand rapid and universal local communication. A laborer who goes to his work with his dinner basket has no occasion to telephone home that he will be late to dinner; the small householder, whose grocer lives just around the corner, would not pay one cent for a telephone wherewith to reach him; the villager, whose deliberate pace is never hurried, will walk every time the few steps necessary to see his neighbor in order to save a nickel. The telephone, like the telegraph, post-office and the railroad, is only upon extraordinary occasions used or needed by the poor. It is demanded, and daily depended upon, and should be liberally paid for by the capitalist, mercantile and manufacturing classes. This talk about oppressing *the people* is the merest rot. It is very true that every man would like to have a telephone if he could get one for nothing, but so would every man like to have horses and carriages, and good things to eat and drink and wear if he could get them for nothing; and the latter would be far more appreciated by the poor man than the telephone. If, therefore, the State must interfere to furnish luxuries cheap to all men, it had better begin with those things which would be most universally welcome.

Another curious thing: in but a limited number of cases have telephone rates been advanced since the beginning. The telephone companies then held out in return for the three or four dollars a month which they charged, the prospect of connecting with a few, say fifty to a hundred, other subscribers. Their expectations have been far more than realized, and they now extend facilities probably four or five times as great as originally offered. How strange and inconsistent it is that people should grumble at paying the same price for a great accommodation that they were originally asked to pay for a small one.

This popular animosity, however unfounded, has culminated in the Indiana rate troubles, and the Government attacks upon the Bell patents. Mr. Storke's able hands have prepared a report and discussion upon legislation. General Barney had hoped to obtain from Mr. Tompkins, of the American Bell, a paper upon the litigation of the year, failing in which (to his great regret) he has asked me to say at this time what I can about it. I have but a general and superficial acquaintance with the subject, and if I misstate shall be glad of correction, or if I omit will welcome any question which may expose the omission. My *résumé* will be based on the recitals of the bill lately filed by the American Bell Company at Chicago vs. Cushman, the latest inventor of the telephone, twenty years before Bell.

It is worth while to review the whole telephone litigation from the beginning. Five kinds of defence have been set up by infringers of the Bell patents:

1. Priority of invention by others, especially Reis, McDonough and Gray.

2. That Bell did not invent the speaking telephone at all; that he intended to invent a multiple telegraph and not a telephone; and that the machine he did invent was inoperative as a telephone until after he obtained his patent, and then worked only by the use of a liquid transmitter devised by Gray.

3. That there was fraud in the issue of the Bell patent in the matter of the Gray caveat.

4. That as a matter of fact the undulatory current patented by Bell, is not the only means of transmitting speech, but that a make-and-break current can be used, and is in practice, employed therefor.

5. That the Government is seeking to cancel the telephone patent.

These defences have been set up and adjudicated in the following cases:

The Dowd case (Western Union): Defences set up, the Gray caveat, the priority claims of Reis, Gray, Dolbear and others, and the claim that Bell's telephone was inoperative. The action of Examiner Wilbur in reference to the Gray caveat was fully in evidence in this suit. After testimony was all in, Mr, George Gifford, counsel for the Western Union, advised them to yield. They did so *with the consent of Gray*, and a decree was entered in favor of Bell by consent in April, 1881.

Spencer and Eaton cases: Decided in June, 1881, by Judge Lowell, in Boston, and Judge Wheeler in New York. Defences set up the inventions of Reis and others, and the claim that Bell's telephone was inoperative. In these cases the Judges decided that Reis had not invented a speaking telephone, nor any method of transmitting speech electrically; that the Bell telephone constructed according to the original patent would talk, and that a carbon transmitter infringed upon that patent.

Dolbear case: Preliminary injunction granted by Mr. Justice Gray, January, 24, 1883, and finally decided by Judge Lowell, June 30, 1883. Defences set up, priority claims of Reis and other inventors, and the proposition that the undulatory current was a natural phenomenon and not patentable. In this case the Reis defence was most elaborately presented. His instruments were tested in Court and failed to transmit speech. Judges decided that the method of transmission by an undulatory current was patentable, and fully described in the Bell patent.

Drawbaugh case: Preliminary injunction granted by Judge Blatchford, in New York, November 18, 1880. Defences set up, Gray caveat; priority of Gray, Edison and Drawbaugh, especially the latter; Bell's telephone was inoperative; Bell had stolen Gray's liquid transmitter. In this case Bell was cross-examined for three weeks. Judgment rendered for Bell by Judge Wallace, in December, 1884.

Ghegan and Hopkins cases (People's Telephone Company); Defences set up, priority of Reis, McDonough, Drawbaugh and others, decided in New Jersey, by Judge Nixon, and in New York, by Judge Wallace, in December, 1885.

Overland cases: In New York, New Jersey, Pennsylvania, Kentucky and Ohio. Defences set up, included all the evidence in the Dowd case, Spencer case, Dolbear case, Drawbaugh case, priority of Reis, McDonough and Vander Weyde; Gray caveat; and that prior decrees were obtained by collusion. These cases were hung up by Judge McKennon, on motion for preliminary injunction at Philadelphia, pending the issue of the Drawbaugh case. As soon as that was decided permanent injunction was granted by Judge Butler and Judge Nixon, in January, 1885, which was followed by iujunctions in all the other States mentioned.

Molecular case: Judge Wallace; injunction granted in June, 1885. Defences set up: priority of Reis, Vander Weyde, Holcomb and Beardsley; prior-

ity and caveat of Gray ; attempt to demonstrate that the Reis Telephone would talk, that Bell's Telephone was inoperative, and that an intermittent current was used. The Molecular Company was also stopped in Ohio by Mr. Justice Matthews and Judge Walker.

Clay case : Decided by Judge McKennon in April, 1886. Defences set up : that Bell's original telephone could not talk ; that Bell invented the telephone after his patent had issued ; that he actually used an intermittent current ; also the priority of Reis. After the argument and before decision had been announced they asked that the case be continued to await the result of the Government suit to cancel the Bell patent. This request was refused by the judges, and decision rendered.

Pittsburgh case : (National Improved or Rogers' Telephone) ; decided in December, 1885, by Judges McKennon and Acheson. Defences set up, same as in the Clay case.

New Orleans case : (National Improved) : Decided in May, 1886, by Judges Pardee and Billings. Prior to the argument in this case the proceedings before the Secretary of the Interior, instituted by the Pan Electric people, had attracted the attention of the entire country, and allegations were made broadcast in the press that Gray had been defrauded ; that Bell's patent was illegally obtained ; that bribery had been committed ; that the original decisions in the telephone litigations were obtained by collusion ; and that all succeeding decisions had followed by comity between the various district courts in the United States. In other words that no telephone case had been tried and decided fairly on its own merits. The anti-monopoly feeling was used to its utmost to prejudice the country against the Bell Telephone. Defences set up ; all the defences raised in the Pittsburgh case, particularly the priority of Reis, the alleged fraud on Gray ; the alleged unfairness of previous decisions, and the necessity of awaiting the result of the Government suit ; and *all grounds of attack which have since been set out in bill of complaint in the Government suit at Columbus.* The defendants introduced in evidence all the testimony which had been exhibited by the Pan Electric people before the Secretary of the Interior in November, 1885, together with several hundred more pages of evidence and two new affidavits from Elisha Gray. Oral arguments occupied twenty-one days, and printed arguments for the defence were filed several weeks later. The decision filed May 31st, 1886, was of the very first importance. The Court held that previous suits were honestly defended, not collusive, and ought to be followed in this case ; but, that there might be no question in future as to the fairness of the decision in this case, the Judges had determined not to rest upon the decrees in other cases, but to examine the questions *de novo.* They declined first of all to defer decision in this case until the conclusion of the Government suit ; they found that Bell invented the method of transmission of speech by an undulatory current ; that his instrument, made according to the patent, would talk (in fact the Judges talked through those instruments in the open court). They found that Bell's application, dated January 20th, 1876, certainly anticipated Gray's first disclosure of his invention February 11th, 1876 ; and that, therefore, even if Gray's invention had been unlawfully made known to Bell, it could not have prevailed ; but that there was nothing in the evidence to show that this

was the case, or that Bell had done anything inconsistent with his right to be called an honest man with clean hands; that Reis' method was based upon an intermittent current, and that his telephone would not talk. Injunction was granted.

Two other cases have been tried since the New Orleans case, and injunction granted in both. One of them, the "Long Case," brought in West Virginia, was defended on the ground that the Government was attacking the Bell Company; but, as before, this defence was not regarded by the judges.

The telephone litigation, in a word, has been one series of triumphs for Alexander Graham Bell, each victory more unqualified than the last. Finally, as is just and right, comes this New Orleans decision with its magnificent vindication of him as an "honest man, with clean hands." I have but the slightest personal acquaintance with that distinguished man, but I can sincerely say that nothing in this masterly opinion so warmed my heart as those simple words. Bell's history has been singularly open these past ten years. He produced his telephone at the Centennial Exhibition of 1876, the most conspicuous occasion upon which it could possibly have been brought out. Immediately, he was known all over the world. He traveled and lectured through the East, in England, France and Germany. Everywhere he was welcomed and recognized as the originator of a truly great invention. He was made one of the fifty members of the American Academy of Sciences; he was made honorary member of learned and scientific bodies in England and on the Continent; degrees were conferred on him by the great universities here, and in England and Scotland; France gave him, at the hands of its great Academy, the Volta prize of 50,000 francs, instituted by Napoleon the Great for discoveries of transcendent interest in electricity, a prize not before given for a generation. All foreign countries gave him their patents, except where publication in America had under their laws forestalled him. Their Courts have defended those patents. In America, two Justices of the Supreme Court, five Judges of the Circuit, and seven Judges of the District Courts of the United States, in thirteen stubbornly contested cases, conducted by the first lawyers of the land, in eight different States, at an expense of nearly a million dollars, upon thirty thousand pages of testimony, have for ten years steadily pronounced in his favor. Meantime, what has he been doing? A scientific man to the core, he made over to his wife, his parents, his father-in-law, the great property derived from his patents, and placidly returned to his first love, the education of deaf mutes. Now and then, just to keep his hand in, as it were, he brings out such brilliant conceptions as his photophone, or his more recent apparatus for photographiug sound. In this honorable retirement, amid all these honors and emoluments, this consensus of the applause of all that is disinterested, scientific, learned and just, it has been reserved for sharpers, who fleece the public with "bogus" telephone stocks; for Wilber, who sells affidavits on both sides for $100 apiece as called for; for Gray, who swears in open Court that he once swore the other way, because he then thought it his interest; for the daily press, in its customary haste to reproduce the sensational; for—alas, that it must be said—the present administration at Washington; it was reserved, I say, for this strangely assorted company to villify and slander him. But now comes Judge Pardee and says he is an

"honest man, with clean hands." "Well," say the Pan Electricians, "Judge Pardee has been bought. Bell was a poor man once, did not have a dollar, but he began and bought the Patent Office, bought the Western Union, and Elisha Gray, and Drawbaugh, and Dolbear, and Judge Lowell, and Justice Gray, and all the other Judges, from Massachusetts to Texas. He bought the American Academy, and the French Academy, the jury that awarded the Volta prize, all the great universities, winding up the other day with Heidelberg, and now he is rich." You may ask why did not the Pan Electricians do the same? They have tried it, and have bagged a few politicians, but, so far, not a single Judge. So much the worse showing for them and their story.

What an extraordinary spectacle is the history of bogus telephony, what a procession of magnificent gas-bags. Look at them: The Dolbear Company, capital $1,000,000; Eaton Company, capital $1,000,000; People's Company, parent, capital $3,000,000; Sub-companies all over America, capital from $500,000 up—that for New York, New Jersey and Pennsylvania alone being $15,000,000; the Overland Company, capital $5,000,000, Sub-companies everywhere with capitals from $500,000 up; the Molecular Company, the Clay Company, the Hopkins Company, the Home Company, the Meucci Company, and fifty others whose capitals I know not; the Pan Electric, parent, capital $5,000,000, Sub-companies all over the country; and last, as far as heard from, not least, Gray's new Company, capital, $10,000,000. Where are these Companies' telephones, their wires, their exchanges, their subscribers, their acquired business; where is anything to attest their existence except worthless stock certificates, disastrous lawsuits, and now and then the damaged name of a politician? In the piping times of Drawbaugh the American Bell Telephone Company, possessing absolute ownership of over half of all the telephone business in the country and an income from royalties and dividends of $2,000,000 a year, was selling in the market for $15,000,000. The Drawbaugh Company, already under injunction, without a pole or wire, or any property of any description except the right to defend lawsuits, was capitalized for three States only at $15,000,000. But its prospectus bore on its title-page, in its largest type, the name of George F. Edmunds, and rightly enough, for this was its sole salable asset. The United States Society rejoiced in the name of Roscoe Conkling. The Pan Electric—but why speak of the Pan Electric? Already the bucolic Garland has pleaded the "baby act" in open court, and swears by all that is good and holy that, if the judge will only let him off this time, he will give up his plunder, and never get into such a scrape again. How little he thought, when taking in his Pan Electric dividends, that this pleasant little game of selling worthless trash to the innocent and ignorant on the strength of his name, would become so tiresome so soon. However, it is always true that statesmen must be educated at the public cost, and his education is progressing. The next telephone sharper who offers him half a million of stock for the use of his name will probably conclude that he has run against a dynamite bomb. In like manner Gen. Joe Johnson, who feared that people might call him a swindler, and Senator Harris, who apparently did not trouble himself about such things, will have their ideas of personal responsibility wonderfully clarified, if a few of their victims sue them upon worthless certificates, bought on the strength of their names. As for the Presi-

dent, it is almost inevitable that the Government suit should share the fate of its predecessors ; in which event the *Detroit Free Press* will probably construct for him one of those delicious dialogues with Dan Lamont, of which it is so fond, something like the following :

Time—Next Summer. Scene—The Adirondacks. President seated on a log, fishing ; Lamont cutting bait. The President speaks :

" Daniel, how is it that telephone suit has gone against us ?"

" I cannot tell, Sire. We did all we could to 'stack the cards.' We hired Thurman, and Lowery, and John Goode, and all the other Pan Electric lawyers ; and we brought the suit before Judge Baxter, who was considered the worst patent smasher in America ; then when he died, we appointed Senator Harris' colleague, a good Tennesseean, who, we hoped, would stand by us every time ; but the confounded Supreme Court was too much for us. They are all Republicans, and the telephone cases up there were so far along that we could not stop them."

" Well, Daniel, is not this decision a severe reflection on the Pan Electric section of our party ?"

" It is, Sire."

" How came it, Daniel, that Mr. Garland was such a guileless fool as to get into that nasty stock swindling enterprise ?"

" He was poor, Sire, and green. He had not cut his eye teeth. His financial experience, he said, had been limited to law and poker."

" But how came Mr. Lamar, who is said to be a lawyer, to commit the Government to such a risky suit in the face of all previous decisions ?"

" He felt compelled to endeavor to whitewash Mr. Garland, Sire, and he thought the suit would please the people, because Bell's Telephone is a monopoly and unpopular."

" But, Daniel, did not Gray and the other opponents of Bell also desire a monopoly to be set up by themselves in the room of Bell ?"

" They did, Sire, It was dog eat dog."

" If they had succeeded, Daniel, would not the Government probably have been called on by its speculative friends to attack all valuable patents in like manner at its own expense ?"

" I think it would, Sire ?"

" Would not this ruin the value of all patents, and eventually break down our patent system ?"

" That can hardly be doubted, Sire."

" Is such a result desirable, Daniel ?"

" No, Sire. All civilized nations maintain patent systems as conducive to national prosperity, and our American patent system has been held up as a model for the world."

" Then, Daniel, with all these facts before me, how came I, even I, a well-meaning President, to be such an inspired idiot as to become the tool of stock sharpers, spending the people's money in a hopeless suit, helping one set of monopolists against another, to the establishment of an evil precedent, the disgrace of my Cabinet, and the discomfiture of my Mugwump friends ?"

" God only knows, Sire. He can understand both the wisdom and the foolishness of man."

"Daniel, if in the inscrutable dispensation of an all-wise Providence it should ever be my lot to enjoy the unspeakable happiness of a second term, I will never do this thing again."

"Amen, Sire."

Pardon me, gentlemen of the Association, if this little allegory seems flippant, or unworthy its occasion or its subject; both are serious enough, and deserve serious treatment at abler hands than mine. It embodies my convictions, and a little ridicule often goes farther than a sermon to illuminate the mischief and folly of letting politics interfere with justice.

As in the case of the granger attacks on the railroads of ten years ago, we may confidently expect that the sober, second thought of the country, that commonsense which underlies the action of the great mass of the American people, will condemn vicious legislation, partisan attacks, in a word, all political interference with the course and natural laws of trade. The statute books of the nations of the world are loaded down with laws regulating trade which have passed into "innocuous desuetude." Provided only that there is a natural demand for a commodity or a service, and that the cost thereof be not disproportionate to its value, the business of furnishing that commodity or service will surely live and flourish in spite of all legal enactments. I have, therefore, gentlemen, abiding confidence in the future growth, stability, and popularity of the telephone up to that day, if that day should ever come, when it shall be taken over by the Government. After that, we, who have so long borne the attacks of the press, the impatience and abuse of the multitude, and the rasping of those individuals who are by nature what the operators call "constitutional kickers," after that, I say, *we* can look on with serene satisfaction, and smile to see how these "slings and arrows of outrageous fortune," which were so galling to us, drop harmlessly back from the thick hide of a stolid Bureaucracy.

THE PRESIDENT—The next business before the meeting is the reading of the report of the Secretary and Treasurer.

MR. GIFFORD—I wish to interpolate something here in the shape of a vote of thanks for the very instructive and very amusing paper that the President has read.

MR. LOCKWOOD—I would move to amend Mr. Gifford's motion by requesting that the President be requested to allow his communication to be placed on the records of the Association and printed.

Vice-President Durant put the motion as amended to a vote, and it was carried unanimously.

The Secretary read his report as follows:

SECRETARY'S REPORT.

NEW YORK CITY, September 6th, 1886.

To the National Telephone Exchange Association:

GENTLEMEN—I have the honor respectfully to submit my report as Secretary of this Association for the year ending on this date.

The beginning of the Association year found us with a membership of 37 active and 30 honorary members. One new active member, the American Telephone and Telegraph Company, was admitted at the Providence meeting, and the four following companies have withdrawn, viz.: American District Telegraph Company, Syracuse, N. Y.; Central Union Telephone Company of Chicago; The Iowa Union Telephone and Telegraph Company of Davenport, Iowa, and the United Telephone Company of Kansas City, Mo. Two honorary members were admitted at the Providence meeting: the Callender Insulating and Water-proofing Company, and Geo. L. Wiley, both of New York; and one, Dr. C. Lemon, of New Zealand, has since been admitted by the Executive Committee, subject to the approval of this meeting. We therefore close the year with 34 active and 33 honorary members.

The Association at its last meeting having taken action enlarging the duties of the Secretary, and directing the establishment of a permanent office, either in New York or Boston, such an office was at once established at 234 Broadway, in the city of New York, where it has remained during the year. From this office has been sent out such information of interest to the telephone business as has been furnished to the Secretary, voluntarily, and upon solicitation by members of the Association, or obtained by him from other reliable sources. Such of this information as was of a public nature has been disseminated by means of printed circulars, while that which was to a certain degree confidential has been so treated, and furnished in private letters, on request. Some members of the Association have been, and are still inclined to withhold information of value, the outgrowth of their own experience, from an evident fear that such information might be made public to their possible disadvantage in the future. Considering the present delicate relations existing between the telephone companies and the authorities and public of several states and cities, such caution is, perhaps, not to be wondered at, but it detracts more or less from the full usefulness of the position of Secretary and the service which he might otherwise render.

On the 1st of last January was commenced the semi-monthly issue of a bulletin or *News-Letter* as it has been designated, which has been published regularly since. From the many kind expressions of approval received from the members of the Association, it would seem that this feature of the work of the office is fully appreciated. Several new features which would undoubtedly add interest to the *News-Letter* have been recently suggested by the President of the Association and others, and may soon be carried into effect.

My predecessor in his report of last year, in which he suggested the present plan of a permanent Secretary's office, outlined as one of the duties thereof the presentation at each annual meeting of "a detailed history of the business of the year." I would willingly have prepared such a history, but judge that the

issuance of the *News-Letter* has accomplished the same result, in a manner more satisfactory to the members, giving them all news of interest at frequent intervals, and in a form less wearisome than the reading of a long and detailed paper at the annual meeting. To give simply a general review would be to trench upon the province of the President in his annual address, and I therefore will refer only to the three most salient features of the year's history. They are 1st, the troubles arising from legislation and attempted legislation, fixing telephone rates to subscribers, after the Indiana pattern ; 2d, the legislation, experiments and actual work incident to the placing of wires under the streets of several of our largest cities, and 3d, the litigation in reference to infringements upon the patents under which the members of this Association are working, probably no previous year having witnessed so many important decisions in favor of the Bell telephone as has the last.

All three of these subjects will be treated ably and at length in papers which have been prepared by different members, and which will be read before you later in the session.

Besides the central offices in New York, Brooklyn and New Jersey, the Secretary has had the pleasure during the year of visiting exchanges in Boston, Providence, Philadelphia, Harrisburgh, Buffalo, Chicago, Cincinnati, Nashville and New Orleans.

In every case he was most cordially received, and he hereby returns thanks for the courtesies extended by the representatives of the telephone fraternity in those cities.

The Report of the Treasurer, which is herewith submitted, shows that the total receipts of the past Association year have been $2,312.05, and the total disbursements, $2,311.15.

A portion of these disbursements, however, were for unpaid bills left over from the previous year, the actual expenses of the year just closed having been $1,997.93.

In like manner, a portion of the receipts was for uncollected dues of previous years ; the actual income for the past year, including a small amount ($75), not yet collected, being $1,887.05.

On the basis of the present membership, and with dues, as proposed, at $50, the income for next year will be $1,700, which, as will be noticed, is somewhat less than the expenses of last year.

The assets of the Association at the present date are :

Cash in hands of Treasurer.	$38 35
Due from Cumberland Telephone and Tel. Co., dues for 1884, 1885 and 1886, and assessment for 1886.....	70 00
Due from Callender Insulating and Water-proofing Co. for initiation fee.....	25 00
Total.....	$133 35

There is also a very small amount of office furniture, about $10 worth, and a large number of copies of the printed proceedings of previous meetings. No definite value can be placed on these last.

It affords your Secretary great pleasure to state that the Association has no liabilities whatever, every claim against it known to him having been paid in full to date.

In closing this report of his first year's duties, it is not for the Secretary to discuss whether the new departure, inaugurated at the last meeting, has proved as successful as was anticipated, or whether it has justified the expectations of those who proposed and advocated it. That is for the members of the Association to decide. Shortcomings have, doubtless, been apparent; no one realizes them more keenly than the Secretary himself.

But that the work of the office can be still further improved and made of great value to the telephone fraternity, he is firmly persuaded.

Respectfully submitted,

C. H. BARNEY,
Secretary.

H. L. STORKE, *Treasurer*,

Dr. *In account with* THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION. Cr.

1885.				1885.				
Sept.	17	To balance from last Report	$37 45	Oct.	15	By Brooklyn Eagle	Voucher No. 56	$2 50
"	17	" J. R. Wiley, Proceedings	2 50	"	15	" B. E. Sunny	" " 57	5 72
"	17	" C. A. Cheever, Initiation Fee	25 00	"	24	" W. D. Sargent	" " 58	300 00
"	17	" Central District and Printing Telegraph Co., Dues for 1885	10 00	"	24	" E. R. Gardiner	" " 59	111 00
"	17	" Chicago Telephone Co., Dues for 1885	10 00	"	24	" C. H. Barney	" " 60	100 00
"	17	" New York and New Jersey Telephone Co., Dues for 1885	10 00	Nov.	7	" C. H. Barney	" " 61	100 00
"	17	" Central Union Telephone Co. Dues for 1884 and 1885	20 00	"	17	" Brooklyn Eagle	" " 62	4 00
"	17	" New England Telephone and Telegraph Co., Dues for 1884 and 1885	20 00	Dec.	16	" C. H. Barney	" " 63	100 00
"	17	" Bell Telephone Co. of Buffalo, Dues for 1884 and 1885	20 00	"	16	" Kissam & Allen	" " 64	4 00
"	17	" Nebraska Telephone Co., Dues for 1885	10 00	1886.				
"	17	" Chesapeake and Potomac Telephone Co., Dues for 1884 and 1885	20 00	Jan.	8	" C. H. Barney	" " 65	100 00
"	17	" Bell Telephone Co. of Philadelphia, Dues for 1885	20 00	"	16	" J. C. Printing Co	" " 66	2 50
"	17	" Metropolitan Telephone and Telegraph Co., Dues for 1885	30 00	"	16	" C. H. Barney	" " 67	9 86
"	17	" Metropolitan Telephone and Telegraph Co., 2 copies of Proceedings	2 50	Feb.	20	" H. L. Storke	" " 68	5 00
				"	20	" C. H. Barney	" " 69	100 00
				"	20	" Am. Press Information Bureau	" " 70	7 55
				"	20	" C. H. Barney	" " 71	5 76
				Mar.	17	" Brooklyn Eagle	" " 72	19 75
				"	17	" C. H. Barney	" " 73	100 00
				"	17	" Am. Press Information Bureau	" " 74	6 00
				"	17	" C. H. Barney	" " 75	10 87

Sept.	17	To Colorado Telephone Co., Dues for 1885	$10 00	Mar.	26	By S. P. Sheerin	Voucher No.	76	$11 00
"	17	" Central New York Telephone and Telegraph Co., Dues for 1884 and 1885	20 00	April	7	" C. H. Barney	" "	77	100 00
"	17	" American Telephone and Telegraph Co., Initiation Fee	10 00	"	17	" Brooklyn Eagle	" "	78	332 75
"	17	" Central Pennsylvania Telephone and Telegraph Co., Dues for 1885	10 00	"	17	" Jersey City Printing Co.	" "	79	10 50
"	17	" Southern Massachusetts Telephone Co., Dues for 1885	10 00	"	17	" Am. Press Information Bureau	" "	80	5 85
"	17	" G. L. Wiley, Initiation Fee	25 00	"	17	" C. H. Barney	" "	81	3 67
"	17	" New York and Pennsylvania Telephone Co., Dues for 1885	10 00	May	8	" C. H. Barney	" "	82	100 00
"	17	" Erie Telephone and Telegraph Co., Dues for 1885	10 00	"	8	" C. H. Barney	" "	83	6 75
"	17	" Erie Telephone and Telegraph Co., Assessment	40 00	"	8	" Electrical Review	" "	84	3 00
"	17	" Providence Telephone Co., Dues for 1885	10 00	"	8	" Am. Press Information Bureau	" "	85	6 40
"	18	" Erie Telephone and Telegraph Co., Dues for 1886	10 00	"	25	" Brooklyn Eagle	" "	86	1 25
"	21	" D. I. Carson, 4 copies of Proceedings of 6th Meeting	5 00	"	25	" J. C. Printing Co.	" "	87	9 25
"	24	" Bell Telephone Co. of Missouri, Dues for 1885	10 00	"	25	" F. B. Jennings	" "	88	75 00
"	24	" Great Southern Telephone and Telegraph Co., Dues for 1884 and 1885	20 00	June	7	" C. H. Barney	" "	89	100 00
"	28	" Wisconsin Telephone Co., Dues for 1885	10 00	"	7	" Am. Press Information Bureau	" "	90	4 65
		Carried forward	$447 45	July	9	" C. H. Barney	" "	91	37 07
				"	9	" J. C. Printing Co.	" "	92	9 75
				"	9	" Am. Press Information Bureau	" "	93	5 55
				"	9	" Brooklyn Daily Eagle	" "	94	6 50
				"	9	" C. H. Barney	" "	95	100 00
				Aug.	9	" C. H. Barney	" "	96	100 00
				"	9	" Electrical World	" "	97	3 00
						Carried forward			$2,126 45

	Brought forward		$447 45
Sept.	28	To Pacific Bell Telephone Co., Dues for 1885	10 00
"	29	" Iowa Union Telephone and Telegraph Co., Dues for 1885	10 00
Oct.	5	" Bell Telephone Co. of Buffalo, Assessment	40 00
"	5	" Michigan Telephone Co., Dues for 1885	30 00
"	5	" American Bell Telephone Co., Dues for 1886	10 00
"	5	" " " " " Assessment	40 00
"	5	" Bell Telephone Co. of Missouri, Assessment	40 00
"	5	" Pennsylvania Telephone Co., Assessment	40 00
"	5	" " " " Dues for 1886	10 00
"	9	" Chicago Telephone Co., Assessment	40 00
"	12	" Missouri and Kansas Telephone Co., Dues for 1886	10 00
"	15	" Bell Telephone Co. of Buffalo, Dues for 1886	10 00
"	15	" American District Telegraph Co., Dues for 1885	10 00
"	15	" Central District and Printing Telegraph Co., Assessment	40 00
"	19	" Michigan Telephone Co., Assessment	40 00
"	19	" Central Pennsylvania Telephone and Supply Co., Assessment	40 00
"	19	" Central Pennsylvania Telephone and Supply Co., Dues for 1886	10 00
"	19	" New England Telephone and Telegraph Co., Dues for 1886	10 00

	Brought forward				$2,126 45
Aug.	9	By C. H. Barney	Voucher	No. 98	16 79
"	9	" Am. Press Information Bureau	"	" 99	6 35
"	31	" C. H. Barney	"	" 100	100 00
Sept.	4	" Am. Dist. Tel. Co.	"	" 101	4 06
"	4	" Am. Press Information Bureau	"	" 102	4 95
"	4	" C. H. Barney	"	" 103	15 25
"	4	" J. C. Printing Co.	"	" 104	37 30
		Balance			38 35

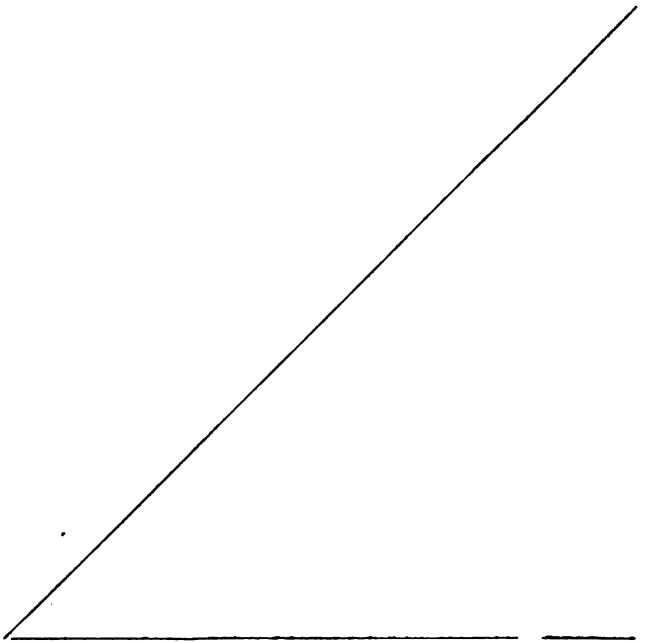
Oct. 19	To New England Telephone and Telegraph Co., Assessment	$40 00
" 19	" City and Suburban Telegraph Association, Assessment	40 00
" 19	" City and Suburban Telegraph Association, Dues for 1885 and 1886	20 00
" 19	" Wisconsin Telephone Co., Assessment	40 00
" 20	" Metropolitan Telephone and Telegraph Co., Assessment	40 00
" 20	" Metropolitan Telephone and Telegraph Co., Dues for 1886	10 00
" 20	" New York and Pennsylvania Telephone Co., Dues for 1886	10 00
" 20	" New York and Pennsylvania Telephone Co., Assessment	40 00
" 21	" Nebraska Telephone Co., Assessment	40 00
" 26	" New York aad New Jersey Telephone Co., Assessment	40 00
" 26	" New York and New Jersey Telephone Co., Dues for 1886	10 00
" 26	" Chicago Telephone Co., Dues for 1886	10 00
Nov. 2	" American Telephone and Telegraph Co., Dues for 1886	10 00
" 2	" American Telephone and Telegraph Co., Assessment	40 00
" 5	" Clark Insulated Wire Co., Initiation Fee	25 00
	Carried forward	$1,302 45

	Carried forward	$2,349 50

	Brought forward	$1,302 45
Nov. 6	To Pacific Bell Telephone Co., Assessment	40 00
" 17	" Chesapeake and Potomac Telephone Co., Assessment	40 00
" 17	" Chesapeake and Potomac Telephone Co., Dues for 1886	10 00
" 17	" Sunset Telephone and Telegraph Co., Dues for 1885 and 1886	20 00
" 17	" Sunset Telephone and Telegraph Co., Initiation Fee	10 00
" 17	" Sunset Telephone and Telegraph Co., Assessment	40 00
" 17	" Bell Telephone Co., of Missouri, Dues for 1886	10 00
" 17	" Nebraska Telephone Co., Dues for 1886	10 00
" 17	" Colorado Telephone Co., Assessment	40 00
" 22	" Providence Telephone Co., Assessment	40 00
" 27	" Colorado Telephone Co., Dues for 1886	10 00
" 27	" United Telephone Co., Dues for 1885	10 00
Dec. 4	" Southern Bell Telephone and Telegraph Co., Dues for 1886	10 00
" 4	" Southern Bell Telephone and Telegraph Co., Assessment	40 00
" 15	" Bell Telephone Co., of Philadelphia, Assessment	40 00
" 15	" Bell Telephone Co., of Philadelphia, Dues for 1886	10 00

Brought forward	$2,349 50

Dec. 31—To Lancashire and Cheshire Telephone Exchange Co. (Limited), copy of Proceedings.		$1 22
1886.		
Feb. 20— " American Bell Telephone Co., 2 copies of Proceedings		2 50
" 20— " American Bell Telephone Co., postage on same		12
" 28— " Wisconsin Telephone Co., Dues for 1886		10 00
Mar. 5— " Bell Telephone Co., of Canada, 3 copies of Proceedings		3 75
" 5— " Bell Telephone Co., of Canada, postage on same		21
" 6— " Central New York Telephone and Telegraph Co., Dues for 1886		10 00
" 6— " Central New York Telephone and Telegraph Co., Assessment		40 00
" 9— " Delaware and Atlantic Telephone and Telegraph Co., Assessment		40 00
" 9— " Delaware and Atlantic Telephone and Telegraph Co., Dues for 1885 and 1886		20 00
" 15— " East Tennessee Telephone Co., Dues for 1886		10 00
" 15— " East Tennessee Telephone Co., Assessment		40 00
Carried forward	$1,860 25	

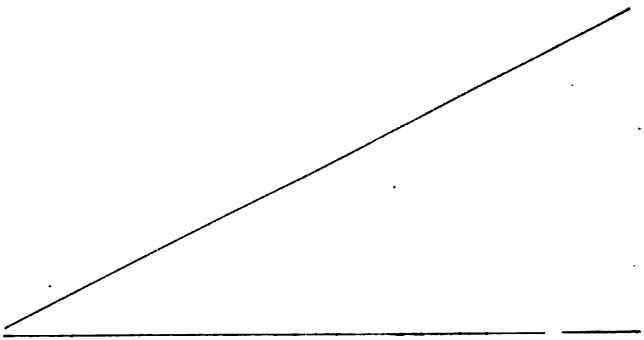


Carried forward		$2.349 50

	Brought forward	$1,860 25
Mar. 16	To Providence Telephone Co., Dues for 1886	10 00
" 26	" Ohio Valley Telephone Co., Dues for 1885 and 1886	20 00
" 26	" Ohio Valley Telephone Co., Assessment	40 00
" 30	" Erie Telephone and Telegraph Co., 14 copies of Proceedings	15 50
April 5	" Great Southern Telephone and Telegraph Co., Dues for 1886	10 00
" 5	" Great Southern Telephone and Telegraph Co., Assessment	40 00
May 1	" Michigan Telephone Company, Dues for 1886.	10 00
" 1	" Hudson River Telephone Co., Dues for 1886.	10 00
" 1	" " " " Assessment	40 00
" 3	" Central District and Printing Telegraph Co., Dues for 1886	10 00
" 12	" Pacific Bell Telephone Co., Dues for 1886	10 00
" 14	" Empire State Telephone and Telegraph Co., Assessment	40 00
" 14	" Empire State Telephone and Telegraph Co., Dues for 1884, 1885 and 1886	30 00
" 15	" Missouri and Kansas Telephone Co., Dues for 1886	10 00
" 15	" Missouri and Kansas Telephone Co., Assessment	40 00

Brought forward	$2,349 50

June 11	To Southern New England Telephone and Telegraph Co., Assessment	40 00
" 11	" Southern New England Telephone and Telegraph Co., Dues for 1884, 1885 and 1886	30 00
Sept. 3	" National Telephone Co. (Glasgow), copy of Proceedings	1 25
" 3	" C. Lemon, Initiation Fee	25 00
" 3	" Southern Massachusetts Telephone Co., Dues for 1886	10 00
" 3	" Southern Massachusetts Telephone Co., Assessment	40 00
" 4	" Western Electric Manufacturing Co., 6 copies Proceedings	7 50
		$2,349 50



$2,349 50

THE PRESIDENT—You hear the Secretary's report? It has summarized the Treasurer's report also.

I would report, on behalf of the Executive Committee, that the Treasurer's report was examined, vouchers checked through and found to correspond with the statement, and balance in hand found correct.

There are also minutes of two meetings of the Executive Committee which the Secretary will read, and the action of the Committee and the Secretary's report will then be laid before the Association as a whole for approval.

The Secretary then read the minutes of the special meeting of the Executive Committee, held at Providence, September 9th, 1885, also minutes of meeting of Executive Committee, held at St. Louis, September 7th, 1886. They are as follows:

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 9TH, 1885.

The Committee met at the Narragansett Hotel, Providence, R. I., at 2 P. M. Present: President Fay, Messrs. Cutler, Metzger and Bailey.

It was voted that the salary of the Secretary be fixed at $1,200 for the ensuing year, in accordance with the action just taken by the Association.

There being no further business, the meeting adjourned

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE.

HELD SEPTEMBER 7TH, 1886.

The Committee met at the Southern Hotel, St. Louis, Mo., at 9:30 A. M. Present: President Fay, Messrs. Metzger and Bailey.

The Treasurer's Report for the past year was received, examined and found correct.

The following were fixed as the hours of business for the present meeting of the Association, viz.: 10 A. M. to 1 P. M. and 3 to 5 P. M.

There being no further business, the meeting adjourned.

C. H. BARNEY,
Secretary.

THE PRESIDENT—You hear the minutes of the meetings of the Executive Committee? All those in favor of accept-

ing these minutes and the reports of the Secretary and Treasurer will express their opinions in the usual manner.

The reports are accepted and will be filed.

The next business before the meeting, gentlemen, is the election of officers for the ensuing year. Nominations are in order. The Constitution provides that the officers shall be balloted for separately. The first nomination is that for the office of President.

MR. METZGER—I nominate C. N. Fay, of Chicago.

MR. DURANT—I second the nomination.

MR. HALL—As there is but one nomination, I move that the Secretary be instructed to cast the ballot of the Association for Mr. C. N. Fay.

The motion was put by Vice-President Durant and carried.

THE PRESIDENT—I thank you for the compliment of re-election and for the kind way in which Mr. Hall has dealt with the embarrassing situation under which the Chairman has to labor in putting a vote for himself.

The next nomination is that for Vice-President.

MR. DURANT—I nominate Mr. W. A. Jackson, of Detroit.

MR. GIFFORD—I nominate Henry Metzger, of Pittsburgh.

MR. DURANT—I withdraw my nomination in favor of Mr. Metzger.

MR. ULINE—I nominate Mr. Durant.

MR. DURANT—I move that the nominations close with the nomination of Mr. Metzger, and that the Secretary be instructed to cast the ballot of the Association for him.

The motion was carried.

Mr. Metzger was called on for a speech.

MR. METZGER—Mr. President and Gentlemen of the Convention: I thank you for the honor conferred upon me (Applause).

THE PRESIDENT—Gentlemen of the Association: It has been found an admirable provision to have the Association visit the home of the Vice-President. Mr. Metzger having

made last year a very strong bid for the next visit of the Association to Pittsburgh, I presume it was with some forecast of the future that we took care of ourselves by electing Mr. Metzger.

The next nomination is that of Secretary.

MR. DURANT—I nominate Mr. Barney.

MR. SARGENT—I move that the nominations be closed, and that the Secretary be instructed to cast the ballot of the Association for Mr. Barney.

THE SECERTARY—I would like to amend that motion so as to read that the Treasurer be requested to cast the ballot.

THE PRESIDENT—The President will cast the vote for Mr. Barney, and relieve the Secretary from that duty.

Nominations for Treasurer are in order.

Mr. Storke was nominated by several members.

A MEMBER—I move that the nominations be closed, and that the ballot of the Association be cast for Mr. Storke as Treasurer.

The motion was carried.

THE PRESIDENT—The next nominations are for one member of the Advisory Committee for three years. Nominations are in order. The nomination will be to fill the place of Mr. Sunny, of Chicago, who was elected last year to fill a vacancy.

MR. LOCKWOOD—It might be well that the Secretary should read the names of the Committee as it now stands.

THE SECRETARY—The Advisory Board as it stood last year was composed of Morris F. Tyler, for three years; W. A. Jackson, for two years, and B. E. Sunny for one year. Now Mr. Sunny's term has expired, and there is a consequent vacancy.

MR. SARGENT—I nominate Mr. Gifford, of Louisville.

On motion, the nominations were closed, and the Secretary authorized to cast the ballot of the Association for Mr. Gifford.

THE PRESIDENT—The Executive Committee, as it stood last year, was as follows:

C. N. Fay, *ex-officio*, Chicago, Ill.; James Bigler, New-

burgh, N. Y.; Henry Metzger, Pittsburgh, Pa.; C. F. Cutler, New York, N. Y.; R. M. Bailey, Williamsport, Pa.

An Executive Committee of four is now to be elected for the ensuing year.

THE SECRETARY—I would state that I have a letter from Mr. Cutler, written from the Adirondacks, expressing his regret at his inability to be present at the meeting of the Executive Committee and of the Association to-day, and requesting that his name be not used for any office, as his arrangements will be such for the ensuing year that it will be impossible for him to attend to any duties, outside of his regular business.

MR. EASTABROOK—I nominate in his stead Mr. Sargent, of Brooklyn.

A MEMBER—I nominate Mr. Bailey.

MR. GLIDDEN—I desire to nominate Captain George M. Stone, of Cincinnati.

MR. BENNETT—I nominate Mr. Keller, of Boston.

THE PRESIDENT—If there is no objection made, the President will put the question that the nominations be closed, and that the Secretary be instructed to cast the ballot of the Association for those gentlemen, viz., W. D. Sargent, R. M. Bailey, George N. Stone, and J. N. Keller.

This was agreed to.

THE PRESIDENT—The next business in order is the fixing of the place of the annual meeting. It requires a two-thirds vote of the members present to do this. What is your pleasure, gentlemen, in regard to the next annual meeting?

MR. METZGER—In accordance with the programme outlined at the last meeting of the Convention, when I had the honor to suggest Pittsburgh as the next place of meeting, succeeding St. Louis, I herewith extend an invitation to the Association to meet at Pittsburgh, at its next regular annual meeting. Pittsburgh is centrally located, within at least, say, thirty-six hours of any point in the United States, excluding, of course, the Pacific Coast, and probably New Orleans, but central for the eastern portion of the country,

and as far as St. Louis and Kansas City. I think we can offer sufficient inducements in the shape of natural curiosities of one kind and another, in the city of Pittsburgh, to make it an object to meet there.

THE PRESIDENT—Mr. Metzger suggests the city of Pittsburgh, and says that it is just the opposite of the small town in Vermont in which I was born, from which it was said you could start and go to any place in the world. He says you can go *to* Pittsburgh *from* any place in the world.

MR. SARGENT—I move that the next meeting be held in Pittsburgh. Is it provided by the Constitution that it must be held on the first Tuesday of September?

THE PRESIDENT—The Association can fix the date by vote.

MR. HALL—I would suggest that the matter of the date be left to the Executive Committee, with power, and with the suggestion that it might be well to make it a little later in the month than the first Tuesday.

THE PRESIDENT—You offer that as an amendment?

MR. HALL—I offer that as a resolution.

THE PRESIDENT—The motion at present is that the next annual meeting be held at Pittsburgh. Does Mr. Sargent accept Mr. Hall's suggestion?

MR. SARGENT—Yes, sir.

THE PRESIDENT—The motion before the house is that the next meeting of the Association be held at Pittsburgh, in the Fall of 1887, and that the date be left with the Executive Committee, with power to determine and notify the members of the Association.

The motion was carried.

THE PRESIDENT—The nomination of the Rocky Mountain Bell Telephone Company, of Salt Lake City, lies before the house. All those in favor of the election of the Rocky Mountain Bell Telephone Company to membership in this Association will express themselves in the usual manner.

The Company was elected to membership.

THE PRESIDENT—An application was presented to the Executive Committee since the last meeting of the Asso-

ciation, nominating to honorary membership Dr. C. Lemon, Superintendent of the Government Posts and Telegraphs, whose residence is at Wellington, New Zealand.

The Committee admitted him under Article IX. of the Constitution, subject to the approval of this meeting.

I am sure that every member of the Association will be delighted to welcome to honorary membership a man from so great a distance as New Zealand.

The admission of Dr. Lemon by the Executive Committee was approved.

THE PRESIDENT—The formal business is now ended, and the time for the presentation of papers has arrived.

MR. HALL—I would like to ask for information, whether the amendments to the Constitution should not be acted on at this time.

THE PRESIDENT—You are right. I think they come up in the ordinary course of business now. If there is no objection the amendments to the Constitution proposed at the last meeting will be considered now. They are as follows:

"ARTICLE XIV. Section 1.—The admission fee shall in all cases be ten dollars, to be paid on signing the Constitution. The anuual dues shall be *fifty* dollars for each vote now had or that may be hereafter acquired under the Constitution, and shall be payable yearly on or before the first day of July in each year." (Proposed by the Executive Committee.)

"ARTICLE IV. Section 1.—The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of *the Secretary and* the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. *The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.*" (Proposed by the Executive Committee.)

"ARTICLE XVII. Section 1.—*Any person may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such election to be by ballot.*" (Proposed by Mr. E. J. Hall, Jr.)

"ARTICLE XVIII. (Additional Article.) Section 1.—*Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.*

"Section 2. *An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments.*" (Proposed by Mr. E. J. Hall, Jr.)

The following change in the By-Laws was proposed at the last meeting by Mr. H. L. Storke, and will come up for action. It is an additional section to Article III.

"Section 5. *The Secretary shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the Telephone business as have heretofore been furnished by the various committees of this Association.*"

MR. STORKE—I acknowledge that I have $38.35 as the funds of this Association in my possession; and if it is expected that that amount of money will run the institution until the first day of July next, I shall have to resign or get another banker. I would move that the first day of July be changed to the first day of October next in the amendment to Article XIV., so that the notices can be sent out immediately, and the Association get the benefit of the funds as soon as needed.

THE PRESIDENT—The President would like to inquire whether the dues have heretofore been paid for the fiscal year of the Association or for the calendar year?

MR. STORKE—For our Association year.

THE PRESIDENT—Do I understand Mr. Storke to offer that as an amendment?

MR. STORKE—As an amendment.

THE PRESIDENT—If no objection is made by any member of the Executive Committee, the amendment to the amendment will be accepted, and the motion will be put upon the amendment as amended.

MR. BAILEY—I would like to inquire if that is practicable? Now, it is probable that the next year the meeting may be deferred until after the first of October, and can notices be sent out?

MR. STORKE—I will see that they are.

THE PRESIDENT—It might be arranged that the fiscal year of the Association shall close on a day certain, say the first of October. Probably that would be a better arrangement—that the fiscal year should close on the first of October without reference to the meeting of the Association, or the first of September better still. Then it would close before

the date of the meeting. Will you embody that in your amendment, Mr. Storke?

MR. STORKE—Yes, sir.

THE PRESIDENT—The amendment will read as follows:

"The admission fee shall in all cases be ten dollars, to be paid on signing the Constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the Constitution, and shall be paid annually on or before the first day of October in each year for the year ending August 31st thereafter."

MR. BAILEY—I would inquire as to these changes in the Constitution and By-laws of the Association; they are carried over a year by the laws of the Association. Can this amendment be added now?

THE PRESIDENT—An amendment germane to the amendment proposed can be adopted at this meeting. The intention of the amendment was to raise funds enough to employ a paid Secretary, and to pay for printing, circulation of information and the like. It has proved so far, by the aid of the small balance carried over from last year, to be sufficient, but, upon the same scale of expenditures for another year, and with the income that we now have in sight based on the proposed tax of $50 a year, it is probable that there will be a small deficit of from $200 to $300. At the time that this sum of fifty dollars per annum was proposed, we hadn't had a year's experience and did not know exactly how much the cost was to run the Association. Our experience seems to me to indicate that we ought to make the dues a little larger—enough to provide Mr. Storke and Gen. Barney with the funds to pay the bills as they come along, without being obliged to advance money for the Association from their own pockets or become individually liable for the Association's debts, which they would have to do, as we are not incorporated under the statutes of any State. It seems to me that to relieve them from any anxiety and put the thing on a business basis the amount of $50 per annum fixed in the amendment should be enlarged to $60 per annum.

MR. STORKE—I will adopt that suggestion.

MR. E. J. HALL, Jr.—If you will allow me to suggest,

the amendment following will have the effect of bringing some twenty additional members, probably, into paying membership, such amendment being designed to transfer the manufacturing members of the Association, who are now honorary members, to the rating of associate members.

THE PRESIDENT—We should be assuming in that case that the amendment you refer to would be passed. Perhaps we had better take up the other amendments first.

MR. E. J. HALL, Jr.—It was discussed pretty thoroughly at the Providence meeting, and it was the unanimous expression of opinion on the part of the manufacturers that they would prefer an arrangement which would allow them to contribute toward the expenses of the Association.

THE PRESIDENT—We can act upon the remaining amendments first, and then come back. We will therefore pass over the first amendment for the moment and consider the second amendment.

"ARTICLE IV. Section 1.—The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of *the Secretary and* the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. *The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.*"

This year we have elected a Secretary. Next year, under this amendment, the Secretary will not be an elective officer, but will be appointed by the Executive Committee, as I understand it.

MR. E. J. HALL, JR.—That amendment, Mr. President, is recommended by the Executive Committee.

MR. DRAKE—Is there good reason why the Secretary should not be elected hereafter, the same as he has been heretofore?

THE PRESIDENT—There was this reason. At the time the Secretaryship had been held as an honorary office, to which was attached a great deal of work, it was suggested that we authorize the Executive Committee to employ a suitable individual, without reference to who he was or

where he might be found, or whether the Association should have selected him to do that work, leaving it within the power of the Executive Committee to take the most available man under the circumstances. Therefore, it was proposed to remove the Secretaryship from the elective offices, and make the Secretary an appointed officer.

MR. DRAKE—That procedure supplied the requisites for those conditions, but now that we have a man as Secretary whom the Association has confidence in, would it not be just as well for us to elect him, and——

THE PRESIDENT—He has been elected for the current year. The only question is as to the future. For instance, if Gen. Barney should remove from New York, we desire it to be within the power of the Executive Committee to fill the vacancy.

MR. DRAKE—In that case would it not be as well to let the Executive Committee fill the vacancy until an election occurred?

THE PRESIDENT—It could be done in that way.

MR. KER—I think it would be preferable for a gentleman to feel that he was elected by the unanimous vote of the Association, rather than by the vote of a few members representing the Association, or who might not represent the Association.

MR. SARGENT—I think it is very much safer to leave the appointment of the Secretary in the hands of the Executive Committee. It was intended to get a competent man and to pay him a salary, and the Executive Committee are the best judges of a proper man. If it is left to the vote of the Association, it seems to me that we would not be as likely to get as good results as if it were left to the Executive Committee.

MR. GIFFORD—I was of the opinion when I first read that amendment, that we were going into the wrong way of doing things, to have the Secretary appointed by this Committee; but on second thought, and particularly after what Mr. Sargent says, I see the point and the wisdom of letting the Executive Committee select a suitable man. Now, our

Secretary is a pretty important man. He is a man that we pay a salary to, and he publishes these *News-Letters;* and. I think, tnat the committee of intelligent men whom we have appointed as the Executive Committee are better prepared to select that man than we who have come from all over the United States and don't know perhaps half a dozen of the candidates. I think the amendment ought to pass.

THE PRESIDENT—Under the Constitution, the Secretary is custodian of the papers, etc., of the Association. Under the new amendment he becomes practically the executive officer of the Association, subject to the Executive Com mittee. The Executive Committee are made responsible for all the doings of the Association. Mr. Sargent, as well as myself, has filled the office of Secretary, and it was from our personal experience that our present recommendation was made. However, gentlemen, the question is before the house.

MR. EASTABROOK—It seems to me, Mr. Chairman, that this case is exactly parallel to one where we should ask our stockholders to vote who should be the General Manager of a Company instead of the Board of Directors.

MR. CARSON—I move that the amendment be adopted.

The motion was seconded.

MR. METZGER—This amendment is to Article IV.?

THE PRESIDENT—Yes, sir.

The amendment was carried.

THE PRESIDENT—The next amendment to be acted on is that of Article XVII., Section 1.

Any person may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such election to be by ballot. (Prcposed by Mr. E. J. Hall, Jr.)

MR. SARGENT—In regard to that amendment, it seems to me that the election of honorary members ought to be done in some other way; that we ought to elect to honorary membership men distinguished in their different callings. It seems to me that they ought to be proposed by the Executive Committee, or by some authority of the Association, and let it be an honorary title.

MR. E. J. HALL, JR.—I think that is a very good suggestion, and I will offer this amendment, inserting after "any person" the words "nominated by the Executive Committee," so that it will read: "Any person nominated by the Executive Committee may become an honorary member of the Association," etc.

The amendment, as amended by Mr. Hall, was carried.

MR. BAILEY—I would like to call the attention of the Association to the previous Section in Article IV., Section 1. Is there any provision for changing the Advisory Committee? I do not think the Advisory Committee is provided for.

THE PRESIDENT—Article X. of the Constitution reads as follows: "An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years."

MR. BAILEY—Then isn't this article you have passed on previously a misprint?

THE PRESIDENT—No, sir. There are three members of the Advisory Committee, only one of whom is elected every year.

The President read the proposed amendment to Article XVIII., which was as follows:

ARTICLE XVIII. (Additional Article.) Section 1.—"*Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.*

Section 2.—"*An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments.*" (Proposed by Mr. E. J. Hall. Jr.)

MR. E. J. HALL, JR.—I move its adoption.

MR. CARSON—I want to inquire, Mr. President, what would be the working of this section with reference to persons who are already honorary members?

THE PRESIDENT—It will have no effect on them what-

ever. You hear the amendment, gentlemen; are there any remarks? The motion is made that it pass.

MR. METZGER—I had hoped to hear the argument of the proposer of this amendment, Mr. Hall, before saying a few words on this matter. I can but reiterate the views that I entertained at the last convention in regard to the admission of manufacturers with the right to vote, as I presume it will be conceded that if we tax them, they should at least have the right to vote. The object of this Association, in the first place, was for the mutual protection of the telephone companies of the country, and not to advance the interests of the manufacturers in any way. If they choose to come here, we have no objection. We are very glad to see them. But I can foresee that at some future time there may be trouble in regard to the unlimited admission of manufacturers into this Association. The proceedings of this Association might be entirely diverted from the legitimate object of its creation. We are here to promote our own interests, which are separate and distinct from the interests of the manufacturers; and while I am perfectly willing that they shall be associate members and shall pay the ordinary admission fees, I think it is not worthy of this Association to ask that they shall be taxed—at least, that is the way it strikes me. It seems to me that some day we will regret very much having admitted manufacturers of the various kinds of telephonic material or telegraphic material, or other material pertaining to electrical plants, into this Association as voting members. They certainly should be voting members, if you have the right to tax them. It is a very serious matter, I think, and well worthy of careful consideration on the part of the members of the Association.

MR. E. J. HALL, JR.—The trouble with the Constitution, as it now stands, is this, that they are really *active* members of the Association, but they stand on our list in the distinguished position of *honorary* members, and it seems to me that it is hardly worthy of our Association that Alexander Graham Bell and other eminent men should be placed in the same rank with manufacturers of call-bells and switch-boards and

cables, who have come here from time to time and been admitted into that position, because there was no other place for them. They now have the privilege of the floor; they have all the privileges of members, except the right to vote. We simply give them a change of title, take from them the rank of honorary members and put them in their proper position as associate members. It is customary in all societies to have those degrees—the active members, who are directly interested in the business; such persons as honorary members as it is desired to confer that honor upon, and such persons as associate members as may be affiliated in kindred interests, but not directly coming under the rules for active membership. It was at the desire of the manufacturers themselves that this amendment was proposed.

MR. METZGER—I have no objections to making a distinctive line between honorary and associate members. I think the suggestion of Mr. Hall in that respect is very good, but the main objection I have is to section 2. Where is the equity, where is the justice to the manufacturers, to make them amenable to the same fees and assessments, and not give them the right to vote? So far as the distinction between honorary and associate members is concerned, I agree with him, and I therefore move that section 2 of Article XVIII. be stricken out.

The motion was seconded.

MR. SARGENT—It seems to me that we need associate members here, and that it is not obligatory on those manufacturers to become associate members. They can come here as they have been coming here heretofore, and get all the advantages of the Association without being associate members. But if they wish to become associate members, I think we ought to have the right to elect them to that office, and if we wish them to pay their dues, I do not see that there is anything indelicate in that. I think that the amendment ought to stand as it is. It is done entirely with their approval.

MR. DURANT—I most heartily second the motion of Mr.

Metzger. It seems to me that when this Association or any other association cannot stand on its own bottom, it should fall. The section which Mr. Metzger brings before us is inequitable to manufacturers, who, by that section, are liable to a tax without certain privileges which accompany the ordinary membershp. It seems to me there are quite a number of men in this Association well able to pay a sufficient amount to meet its expenses. When there are not, I think it should be dissolved. Certainly the conflict of interests between manufacturers and users is growing more and more every year. I have seen more of it this year than ever before. A line should be drawn between the two, not only in rights, but in finances. It seems to me they should not be taxed, except a nominal sum for such privileges as they are entitled to.

THE PRESIDENT—The Chair would say in justice and in courtesy to the manufacturers that this whole amendment originated last year, as doubtless most of you remember, by an offer on the part of the manufacturers to contribute to the running expenses of the Association. Now the only conflict of interest between the manufacturers and the Association which has yet come up, and one upon which the opinion of the Association has been so definitely expressed, is the right of the manufacturers to champion their wares upon the floor of the Association. Of course, as manufacturers they are here to meet us as consumers, and to sell us their goods if they can—at any rate, to keep pleasant relations with us, and to get the benefit of our experience as elicited in our various papers and communications. It is undoubtedly to our interest that they should have the benefit of all public discussion here on this floor relative to what they produce and sell to us; but the Association has three times expressed its disinclination to receive from a manufacturer a paper or communication in respect to the particular article which he has to sell. Now, if we take money from the manufacturers it seems to me as if almost the only return that we can make them, or as if at least half of the return that we could make them, would be the right to talk upon their

patents on this floor. I think that the Association does not wish to resolve itself, or at least my feeling would be, that the Association does not wish to become a jury of experts, to try any manufacturer's claims on his own pleadings, or to hearken to the arguments of another manufacturer on the other side. Each one of us wishes for himself to hear and determine. As a body we have carefully refrained from expressing opinions on manufactured goods. The only question of propriety that strikes me as at all pressing is whether we can with self-respect accept the manufacturers' contributions, and at the same time deny them the right to vote in our proceedings. My personal opinion is that as associate members they should be welcomed, but that if they pay any dues at all it be only such a sum as might reasonably be charged against the benefit they derive from the criticisms of their products here on the floor.

On motion of Mr. Drake, the Convention then adjourned until the afternoon.

AFTERNOON SESSION.

The Convention was called to order at 3 P. M.

THE PRESIDENT—The business before the Association is at present on the amendment to the Constitution proposed by Mr. Hall—the amendment to Article XVIII., which reads as follows :

"ARTICLE XVIII. (Additional Article.) Section 1.—*Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.*

"Section 2. *An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments.*" (Proposed by Mr. E. J. Hall, Jr.)

MR. CHERRY—I hope that the amendment will prevail. I think it is the proper thing. Manufacturers are now classed as honorary members, which is certainly a misnomer. It seems to me the proper classification would be associate

members. Those of us who are now honorary members, of course can avail ourselves of the privilege of transferring our membership to associate membership. It seems to me entirely proper that the manufacturers in that connection should bear their share of the expense of the Association, and I think most of them would be very glad to do it. Of course, those who take a different view can maintain their present membership as honorary members. I think the question of allowing them to bring papers in here should not be entertained. In fact, I think no paper should be read before this Convention that has not passed the inspection of the Executive Committee, and I think if any manufacturer wants to present a paper to this Association, and the same was approved by the Executive Committee, that it would be proper for them to read it, not otherwise. I hope, therefore, gentlemen, that you will pass the amendment as proposed. I think it is eminently proper, and I think most of the manufacturers entirely accord with me in that respect.

MR. METZGER—I regret very much that I feel compelled to be so determined, so far as my own individual opinion goes, as to the inadvisability of this proposed action. It does seem to me, and I can but repeat what I said this morning, what are we to gain? A few hundred dollars! That is the sum total as representing the value of the admission of manufacturers to the Convention—a few hundred dollars! What may we lose? I can foresee the time when it will be the interest of the Telephone Association to exclude from its councils the manufacturers. If you pass these amendments you could not exclude them even from executive session, because they are entitled to be present at all the meetings, and are only barred out from exercising the right to vote. I believe I state the case correctly. What is the situation, so far as regards the manufacturers? They come here simply to advance their own personal interests. Mr. Cherry comes here representing the Standard Electrical Works of Cincinnati—to do what? To sell material or the products that he manufac-

tures to the individual members of this Association. Another man comes here to sell cables—all simply to promote their own individual interests. We are here to promote not the individual interests of any member of the Association, but to promote the general good of all. The time may come when the manufacturers can demand the right to sit in executive session and participate in it, and in fact influence the entire action of this Association. To what extent this may be carried, is, of course, a matter for the future to determine; but it does seem to me that it is well worthy the careful attention of the members of this Association at least, if nothing else is done, to lay this matter over another year before you commit yourselves to this programme.

MR. SEELEY—I believe that we are indebted to the manufacturers at the present time for the high state of the art in which the telephone now exists. I think that they should be admitted as members of the Association. I now move that you put the resolution to a vote.

MR. SARGENT—Mr. Metzger says that the only thing that we gain is a few hundred dollars. I think that we gain more than that in putting these honorary members into the class of associate members, where they belong. We blundered in allowing them to be elected as honorary members, and we want to right that blunder. We will certainly gain that much, aside from the few hundred dollars, and I think that they should pay their dues. The dues can be reduced if you please. If they are not full members and do not have the right to vote, it seems to me it is impossible for them to control the Association under the Constitution. We have them with us, and this is simply changing their status from one place to another.

MR. METZGER—You can do that by amending Article XVIII. My motion was to strike out Section 2 of that Article.

MR. SARGENT—And let them in free?

MR. METZGER—Let them in under the same regulations as have been in force, paying the same admisson fee as heretofore.

MR. KELLER—Wouldn't they have the same power as if they paid $50 a year?

MR. METZGER—I do not think so.

MR. KELLER—They don't have the right to vote, do they?

MR. METZGER—No; but if we have the right to tax them, it seems to me that the right to vote is a question of time.

MR. KELLER—Then we will have to amend the Constitution to give them the right to vote.

MR. METZGER—I say that is only a question of time.

MR. KELLER—Let us leave that for future generations to decide.

MR. EASTABROOK—I move to amend Section 2, as printed, so as to read as follows:

"Associate members shall have no vote in the meetings of the Association, but shall be entitled to all the privileges of regular members except in executive session," etc.

Inserting the words "except in executive session" after the word "members."

MR. DRAKE—Wouldn't that amendment strike out the dues and assessments?

MR. EASTABROOK—Not at all.

MR. SARGENT—I second that amendment. I think that is in the right direction.

THE PRESIDENT—The Chair would state that it has at all times been the policy of the Association not to attempt to promulgate binding decrees for the governance of its members. It has been merely a voluntary association for the gathering and dissemination of information, for personal intercourse among the representatives of the various companies, and kindred objects. It strikes me, therefore, after hearing all that has been said, that Mr. Metzger's fear may be exaggerated, because the Association, if it were dominated by manufacturers, if it could be dominated by manufacturers, being as it is a voluntary association with no power to bind its members—if it could be dominated by them it would simply fall to pieces, like a rope of sand, by the withdrawal of the exchanges—the active members. The ques-

tion has been called for by Mr. Seeley. That was not seconded. Mr. Eastabrook moved to amend by inserting the words, "except in executive session."

MR. METZGER—There is only one remark I desire to make in addition to what I have said. Here we are associated together as the National Telephone Association, licensees of the American Bell Telephone Company. The time will come when the patents of the Bell Company will expire. Every manufacturer that is a member of this Association could go on and make telephone instruments, start telephone exchanges, if he chose—and what then? What will be his interest? What will be the interest of the manufacturer who makes telephone materials? Will it be the interest of the present Telephone Association? Will it be the interest of the present Companies? It does not seem to me that it will be.

MR. KELLER—What is going to become of them if they are left as honorary members?

MR. METZGER—Why, they will go on, of course, and do as they would do as individuals.

MR. KELLER—Don't they have the same privileges now that they would have as associate members?

MR. METZGER—That is true.

MR. KELLER—What are they going to do with them, then?

THE PRESIDENT—That is the conundrum.

MR. KELLER—Can't we control them as associate members as readily as we can as honorary members?

MR. METZGER—That is true, gentlemen; but suppose the manufacturers come into this Convention and say, Gentlemen, you took us and you fixed a tax without allowing us to vote. Is it just?

MR. DRAKE—They can withdraw.

MR. METZGER—They can withdraw, but will they?

MR. HALL—I think that Mr. Metzger is entirely right in his idea; that people who have simply an associate interest with us as manufacturers should not participate in the discussions which we may see fit to have hereafter in executive

session. There may be matters which are connected directly and solely with the operations of our business that we may prefer to discuss by ourselves. I think Mr. Eastabrook has met that very nicely, and I do not see how there can be any reasonable objection to it by manufacturers, that when the active members of the Association desire to go into executive session they should have the privilege of doing so by themselves. If manufacturers accept this associate membership, with the restrictions with which we have surrounded it, I think the active members would be entirely safe in conducting their affairs.

MR. SARGENT—There is another point in connection with Mr. Metzger's remarks, that is, the termination of the patent. We are now licensees of the American Bell Company, and when the patent expires we shall no longer be licensees of that Company, and it seems to me that then our Association will cease to exist, or that it will have to be reorganized on an entirely different basis. Until that time arrives we can certainly protect ourselves fully from the associate members.

THE PRESIDENT—Does Mr. Hall accept Mr. Eastabrook's suggestion?

MR. HALL—Yes, sir.

MR. METZGER—The motion to strike out Section 2 was made this morning, sir.

THE PRESIDENT—I did not understand that to be the case. But if the motion was made this morning and seconded, I will put it now, if there is no objection.

MR. HALL—Before the vote is taken to strike out Section 2, I would suggest that we see what position that would put us in. Section 1 provides for the associate members. It defines nothing whatever as to their status, obligations, rights or duties.

MR. KELLER—I was going to ask that the Section, as it is proposed to be amended, be read.

THE PRESIDENT—I understand that Mr. Metzger's motion was seconded this morning. Do you remember who seconded it, Mr. Metzger?

MR. DURANT—I seconded it.

THE PRESIDENT—Then that motion is now before the house, and the Chair was out of order in entertaining this intermediate discussion.

MR. DURANT—I would suggest, before we take a vote on that, that the Secretary read Section 2 of Article XVIII. If I understand, Mr. Metzger's resolution applied to Section 2, which reads as follows: "An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, and shall be subject to the same dues and assessments." It is only the latter part of the sentence that I see any serious objection to.

MR. HALL—I think it would be entirely in order to call for a debate on this amendment, and ask that the matter be taken up by sections. I call for a vote on the first section.

THE PRESIDENT—I think, Mr. Hall, you are out of order on that point. I have ruled already that Mr. Metzger's motion is entitled to precedence. He moved to amend the amendment to the Constitution by striking out Section 2.

MR. GIFFORD—Before taking that vote, it occurs to me that the first section here, which provides for separating the honorary from the associate members, we probably all agree on; but we have got to do something with them after that. I am going to vote against striking out that second section; but I am going to vote to amend it when we come to that part of the question. It occurs to me that the first section ought to be passed, and then the second section ought to be amended to meet the wishes of the majority.

THE PRESIDENT—The motion before the House is on Mr. Metzger's motion to amend Article XVIII., by striking out Section 2.

The motion was lost.

MR. EASTABROOK—Now I renew my amendment to Section 2.

THE PRESIDENT—Mr. Eastabrook now offers an amendment to Section 2, that it read as follows:

"An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments."

Mr. Eastabrook's amendment is accepted by Mr. Hall.

The amendment was carried.

MR. GIFFORD—Now, I move to strike out in the second section, all after the words "executive sessions."

THE PRESIDENT—You are too late; the amendment is now carried, and you will have to wait another year in order to introduce another amendment.

MR. GIFFORD—Can I not introduce another amendment?

THE PRESIDENT—You can, if you get that amendment reconsidered.

MR. GIFFORD—I will tell you what I want to do. I want to strike out this clause: "And shall be subject to the same dues and assessments." If these gentlemen do not have the right to vote and to admission to executive session, we do not want their money. Let them come here and make their display, and we will learn all we can, and they may learn all they can from our suggestions; but if they do not have a right to vote and are excluded from the executive sessions, we do not believe in taxation without representation, and do not want their money. That is my object; I move for a reconsideration of the vote.

MR. BAILEY—I second that motion.

The motion to reconsider was lost.

THE PRESIDENT—The motion to reconsider is lost, and the amendment is adopted. I would say, gentlemen, that the manufacturers have all through expressed a wish to contribute, and, perhaps, as a matter of courtesy to them, it is better to accede to their wishes in that respect. Now, the question on Article XIX. comes up, which we passed over this morning. The amendment, as proposed, is as follows:

"The admission fee shall, in all cases, be ten dollars, to be paid on signing the Constitution. The annual dues shall be fifty dollars for each vote now had, or that may be hereafter acquired under the Constitution, and shall be paid

annually, on or before the first day of October in each year, for the year ending August 31st thereafter."

The amendment was carried.

MR. SCLATER (of the Bell Telephone Co., of Canada)—I am not quite clear about my status here now. I have not taken any part in this discussion, because I saw it was particularly addressed to the manufacturers. It seems to me that our position is rather an anomalous one. We are not manufacturers. We can hardly ask to be honorary members.

THE PRESIDENT—The article does not define the qualifications of an associate member as necessarily being those of a manufacturer. "Any person or corporation actively interested in the objects of this Association may become an associate member." You are at present an honorary member. It is entirely optional with you to remain as you are or to come in as an associate member.

MR. CARSON—I just want to ask if there is any objection to the Bell Telephone Company of Canada coming in as a regular active member?

THE PRESIDENT—It was decided three or four years ago that they were not eligible for active membership, not being licensees of the American Bell Company of the United States.

I think this concludes the formal business of the Association.

MR. BAILEY—I beg pardon, Mr. President; that amendment to the By-Laws has not been acted on yet.

THE PRESIDENT—That is true. The following change in the By-Laws was proposed at the last meeting by Mr. Storke, and it will now come up for action:

"SECTION 5.—The Secretary shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business as have heretofore been furnished by the various committees of this Association."

I think there will be no discussion on that amendment to the by-laws. If I hear no objection, I will put the motion at once.

The amendment was adopted.

THE PRESIDENT—This amendment is only carrying out the action of the Executive Committee, already taken.

Gentlemen, we have the following papers ready for presentation:

"Exchange Statistics," by the Secretary.

"Protection of Switch-boards from Lightning and Heavy Currents," by Mr. Lockwood.

"Underground Work in Brooklyn," by Mr. Sargent.

"Cables and Underground Work," by Mr. Fay.

"Long Distance Telephoning," by Mr. Hibbard.

"Legislation," by Mr. Storke.

The paper on "Legislation," and Mr. Fay's paper on "Cables," will not be ready before to-morrow. We have, therefore, the choice of the others for the afternoon. If no objection is made, we will hear the paper on "Statistics" this afternoon.

MR. CARSON—Before the reading of the papers is taken up, I would like to present a suggestion that the members of the Convention make up a subscription for the relief of Charleston, South Carolina. Everybody has read the newspapers, and substantially knows as much about it as I do. But I was in Charleston on Friday last, and the newspapers have not exaggerated the situation. Every dollar that we can send there will be appreciated, and it seems to me that it would be a very appropriate thing for us to chip in, say $10 apiece, and make up an amount that might be sent there by telegraph to-morrow morning, and an acknowledgment of it received before the Convention adjourns, and I would like to make that suggestion.

THE PRESIDENT—May I ask in what form you wish this contribution to be made? Do you wish to make it a matter of record of the Association, or as a contribution made up by members?

MR. CARSON—I cannot say that I have a positive wish in the matter. I think that might be left to the judgment of the members. But I should think that it might be considered as a contribution by *members* of the Convention. It

certainly cannot be a contribution of the Association, but it might be entered on the minutes in the shape of a memorandum or record of the fact, without impropriety, I think.

MR. DURANT—I think the suggestion is a very timely one, but the donation should come from the Association, not from the individual members. It should be a contribution from the National Telephone Exchange Association. I cheerfully endorse Mr. Carson's suggestion in any way it can be carried out. I think the more speedily it is done the better.

MR. DRAKE—I do not think that a contribution by the Association is a proper expenditure of our funds. The Nebraska Telephone Company pays its proportion each year for the expenses of the Association. I, as an individual, have contributed to the fund in Omaha. I am not prepared to contribute anything further in the name of the Nebraska Telephone Company. I don't think the Association has a right to expend its funds in that direction, and I think it should be made up by individual contributions.

MR. KER.—As most of the gentlemen here, or a great number of them, are representatives of companies, and as the money of those companies belongs to the shareholders, it is perhaps a stretch of discretion to pay the shareholders' money when they have no notion of what it is to be paid for. Therefore I think it is a thing that should be got up by individual effort, and I think that probably it would be more regular to do it in that way. Let the regular business take its due course before unofficial matters are brought up.

THE PRESIDENT—The Chair would say that on the whole Mr. Ker's position strikes him as correct. It would be far from his wish to do anything to damp the success of a motion so entirely commendable as Mr. Carson's. I shall very gladly individually subscribe, and I hope that every member here will. But I do think it is questionable whether as an Association we ought to undertake it.

MR. CARSON—I did not for a moment intend to convey the idea that any contribution was to be made by the members here on behalf of their Companies as representatives,

but as individuals entirely. But I thought that it would be very easy and very convenient for us to appoint some one to receive the money and make up a purse right here, and let it be sent in a lump as contributed by the members of the National Telephone Convention now in session at St. Louis.

THE PRESIDENT—I suggest, then, that Mr. Carson take a paper and go right around now.

MR. EASTABROOK—I move that a committee of three be appointed to collect subscriptions for the Charleston sufferers, and send it on as a contribution from the delegates to this Convention.

The motion was carried.

THE PRESIDENT—The Chair will appoint Mr. Eastabrook, Mr. Carson and Mr. Durant.

MR. DURANT—I must ask you to excuse me, as I have so many other things to look after during the meeting of the Association.

THE PRESIDENT—Well, the other members will manage it. Is there any other miscellaneous business to be introduced before proceeding to hear the paper on "Statistics?"

Vice President Metzger here took the Chair.

THE SECRETARY—I have received the following letters from members of the Association, expressing their regrets at not being able to meet with us; with your permission I will read them now.

The Secretary then read letters from Messrs. Morris F. Tyler, W. A. Jackson and George N. Stone.

THE CHAIRMAN—What disposition shall be made of the correspondence?

MR. FAY—I move that it be received and filed, Mr. President.

The motion was carried.

THE CHAIRMAN—The Secretary will now read the report on "Statistics."

The Secretary then read the following paper:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office,
NEW YORK CITY, September 1, 1886.

MR. PRESIDENT AND GENTLEMEN—In accordance with the vote of the Association at its last annual meeting, I have the honor to present the Statistics formerly compiled by the Committee on Exchange Statistics, and last year so ably presented by Mr. B. E. Sunny, of Chicago.

On the 10th of July last, I addressed a circular to all members of the Association, with the request that the series of questions embodied in the circular should be filled out with answers and returned to me, on or before July 26th. The first returns were received from the Pennsylvania Telephone Company, on the 28th, in the morning, followed by those from the New York and New Jersey Telephone Company in the afternoon of the same day. The majority of the reports, however, were not received until various dates during the month of August, and several only within the past week. It is a matter of regret that the requests from this office for statistical information are not more universally complied with. I have to repeat the complaint made last year, that some of our largest companies, some that could give us information most valuable for comparisons, have failed to report. And the list of delinquents for this year is almost identical with that of last year, and with that of the year before.

Reports have been received from forty-six exchanges, representing 47,000 subscribers; these reports have been made from 21 companies, and 12 have not reported.

Exchanges in cities of over 50,000 population, furnish the most valuable information for purposes of comparison. Of such, there are 41 in the United States, representing about 63,000 subscribers. Of these, twenty-three exchanges, representing about 38,000 subscribers, have reported.

Following out the excellent plan of Mr. Sunny last year, I have made the first comparative table to include the population, the number of subscribers, the increase since last year, and the present ratio of subscribers to inhabitants.

TABLE NO. 1.

EXCHANGE SUBSCRIBERS

Cities of over 150,000 Population.	Population.	Subscribers, 1886.	Increase over 1885.	Present ratio. 1 to every	Subscribers. 1885.	Subscribers. 1884.	Subscribers. 1883.	Subscribers. 1882.
Baltimore.....	417,220	1,863	233	224	1,630	1,450	1,220	1,017
Boston.....	362,535	1,847	151	196	1,696	.....	.....	.....
Brooklyn.....	566,663	2,797	443	203	2,354	1,846	1,601	801
Buffalo.....	155,134	1,702	169	91	1,533	1,420	1,208	1,047
Chicago.....	510,373	4,067	437	125	3,630	3,246	2,903	2,596
Jersey City.....	161,093	693	45	232	648	391	346	.....
Louisville.....	155,917	1,436	165	109	1,271	.....	.....	.....
Milwaukee.....	160,000	1,516	141	106	1,375	1,163	960	.....
New Orleans....	216,140	1,109	Loss 44	194	1,153	.....	.....	.....
New York.....	1,206 299	6,043	791	200	5,252	4,808	4,158	3,451
Pittsburgh.....	247,765	1,951	263	127	1,688	.....	.....	.....
Providence.....	185,000	3,168	366	58	2,802	1,892	1,745	.....
Washington....	159,871	1,272	134	126	1,138	872	.....	.....
Cities of from 50,000 to 150,000 Population.								
Camden.....	52,884	230	15	230	215	.....	.....	.....
Denver.....	55,000	779	28	71	751	723	680	620
Detroit.....	116,000	2,285	329	51	1,956	1,700	1,474	.....
Lowell.....	68,000	587	Loss 213	116	800	.....	.....	.....
Paterson.....	61,811	640	Loss 11	97	651	551	473	.....
Reading.....	55,743	563	6	99	557	.....	.....	.....
Richmond.....	63,597	506	79	126	427	354	347	.....
Rochester.....	89,366	935	127	96	808	724	607	549
Utica.....	40,000	600	.....	67	.....	.....	.....	.....
Worcester.....	68,389	645	Loss 132	106	777	.....	.....	.....

There are returns from so many exchanges in cities of less than 50,000 population that I will not read them here, but they will be found in the printed report.

Twenty-two (22) exchanges in the above list, reporting last year and this, had in 1885, 33,112 subscribers. This year they report 36,634, a net gain of 3,522, or nearly eleven per cent., which was the percentage of increase from 1884 to 1885. New York gained the largest number of subscribers, 791, an increase of 15 per cent., but, as a *comparative* gain, this record is beaten by that of Richmond, which gained 79, or 16 per cent., by that of Detroit, which gained 329, or nearly 17 per cent., and that of Brooklyn, whose increase was 443, or 19 per cent. New Orleans shows a *loss* of 44, probably due to the competition of the Crescent City (National Improved) Telephone Company, which operated quite a large exchange during the greater portion of the year, but which has recently

been enjoined by the United States Courts. Lowell and Worcester both show heavy losses, the former 213, and the latter 132. These losses are understood to be in consequence of a raise in rates, and will undoubtedly be recovered during the ensuing year.

Detroit seems to be the field best supplied with telephones, there being one station to every 51 inhabitants, Providence coming next, with one to every 58 inhabitants. At the other end of the list, Jersey City has only one to every 232 of her population.

The next table exhibits the average number of connections daily. The business of twenty-three offices is given, and that of fourteen compared with previous years.

TABLE NO. 2.

DAILY CONNECTIONS.

Exchange.	1886.	1885.	1884	1883.	1882.	1881.
Baltimore	12,500	10,481	.....	.....	.....	.....
Boston	12,043	10,385	.....	.....	.....	.....
Brooklyn	14,675	10,809	5,508	4,741	.....	.....
Buffalo	6,485	5,980	5,480	5,290	3,842	2,304
Chicago	32,996	31,368	27,101	22,000	16,044	16,136
Jersey City	4,000	.....	.....	.....	.....	.....
Louisville	12,000	.....	.....	.....	.....	.....
Milwaukee	6,031	4,461	.....	.....	.....	.....
New Orleans	7,381	6,791	.....	.....	.....	.....
New York	39,660	36,153	25,912	25,891	19,727	.....
Pittsburgh	14,435	11,583	.....	.....	.....	.....
Providence	14,423	12,046	.....	.....	.....	.....
Washington	6,705	3,939	2,782	.....	.....	.....
Camden	1,042	.....	.....	.....	.....	.....
Denver	4,528	4,467	5,298	4,179	3,450	.....
Detroit	31,723	20,800	.....	.....	.....	.....
Lowell	2,265	.....	.....	.....	.....	.....
Paterson	2,800	.....	.....	.....	.....	.....
Reading	2,500	.....	.....	.....	.....	.....
Richmond	4,307	4,072	3,013	.....	.....	.....
Rochester	4,479	.....	.....	.....	.....	.....
Utica	2,696	.....	.....	.....	.....	.....
Worcester	2,450	.....	.....	.....	.....	.....

Taking the fourteen exchanges which reported last year and this, we find that the daily connections have increased from 173,335 in 1885, to 207,892, an increase of 34,557, or 20 per cent. This only shows what is well known to every telephone man, that the number of connections increases in a greater ratio than the number of subscribers, generally speaking. This rule, however, does not seem to hold good in all cases, inasmuch as New York, which has added 791 new subscribers, only makes 3,500 more daily connections than last year, and Chicago with a gain of 437, only increases its connections 1,628 daily. But

Brooklyn which has increased its list of subscribers 19 per cent., gains 36 per cent. in the number of connections made, and Detroit, which has gained 17 per cent. in subscribers, makes 50 per cent. more connections daily than in 1885. No exchange shows a falling off.

Table No. 3 shows the average daily calls per subscriber. The daily use of the telephone is of course double the number of calls as given below :

TABLE NO. 3.

CALLS PER SUBSCRIBER.

Exchange.	1886.	1885.	1884.
Baltimore	6.7	7.	6.8
Boston	6.5	6.	.....
Brooklyn	5.2	4.5	3.6
Buffalo	3.8	3.9	4.3
Camden	4.5	.....	.....
Chicago	8.1	8.6	8.4
Denver	5.8	6.	7.3
Detroit	13.8	10.6	.....
Jersey City	5.7	.....	.....
Lowell	3.8	.....	.....
Louisville	8.3	.....	.....
Milwaukee	3.9	3.2	.....
New Orleans	6.6	5.9	.....
New York	6.5	7.	5.1
Pittsburgh	7.3	6.8	.....
Providence	4.5	5.2	5.
Paterson	4.3	.....	.....
Richmond	8.5	9.5	8.8
Rochester	4.	.....	.....
Reading	4.4	.....	.....
Utica	4.4	.....	.....
Washington	5.2	3.5	.....
Worcester	3.7	.....	.....

As last year, the Detroit subscribers show the greatest appreciation of the telephone, and seem to use it still more than then. In 1885 their average was ten and six-tenths times daily ; in 1886, it is thirteen and eight tenths times. Boston, Brooklyn, Milwaukee, New Orleans, Pittsburgh and Washington returns indicate an increased use, while Baltimore, Buffalo, Denver, New York, Providence and Richmond show a falling off.

Table No 4 gives the number of connections lost or delayed for such causes as "busy," "don't answer," and "in trouble." This table is hardly fair material for comparative purposes, as the circumstances and methods of different exchanges differ so widely, but it is given as reported by the several exchanges.

TABLE NO. 4.

LOST OR DELAYED CONNECTIONS.

Exchanges.	1886.		1885.		1884.	
	No. daily.	Per cent.	No.	Per cent.	No.	Per cent.
Baltimore	900	7.2	900	9.	800	8.
Boston	1,021	8.5	618	5.	.....	.....
Brooklyn	817	5.6	506	5.	634	11.
Buffalo	421	6.5	446	7.	520	9.
Camden	61	5.9	.....	.....	.....	.....
Chicago	3,852	17.	2,759	8.7	1,355	5.
Denver	186	4.1	.....	6.	.....	.....
Detroit	2,100	6.6	2,120	10.	.....	.....
Jersey City	200	5.	.....	.....	.....	.....
Lowell	195	8.6	.....	.....	.....	.....
Louisville	Estimated at 10.		.....	.....	.....	.....
Milwaukee	2,052	34.	892	20.	.....	.....
New Orleans	600	8.1	426	6.	.....	.....
New York	2,180	5.5	1,959	5.5	1,789	8.
Pittsburgh	1,397	9.7	1,085	10.	.....	.....
Paterson	125	4.5	.....	.....	.....	.....
Rochester	292	6.5	.....	.....	.....	.....
Reading	150	6.	.....	.....	.....	.....
Utica	136	5.	.....	.....	.....	.....
Washington	738	11.	777	1.9	602	20.
Worcester	125	5.1	.....	.....	.....	.....

As last year, Milwaukee has the heaviest percentage, which is said to be due to the frequent calls for railroad offices that are busy. Its proportion of "missed calls" is 34 per cent. The exchange making the best showing is Denver, with 4.1 per cent.

Table No. 5 shows the average number of connections made daily by each subscriber operator from 8 A. M. to 6 P. M. Twenty-two exchanges are reported; thirteen are compared with last year.

TABLE NO. 5.

CONNECTIONS PER OPERATOR.

Exchange.	1886.	1885.	1884.	1883.	1882.
Baltimore	595	390	.....	.....	.....
Boston	514	375	.....	.....	.....
Brooklyn	367	277	177	132	.....
Buffalo	233	233	221	263	148
Camden	197	.....	.....	.....	.....
Chicago	300	290	271	202	161
Denver	269	291	360	379	246
Detroit	709	710	.....	.....	

CONNECTIONS PER OPERATOR—*Continued.*

Exchange.	1886.	1885.	1884.	1883.	1882.
Jersey City	400	.....	.....	.....	.....
Lowell	324	.....	.....	.....	.....
Louisville	633	.....	.....	.....	.....
Milwaukee	335	281	203	269	.....
New Orleans	1,054	848	.....	.....	.....
New York	200	255	145	120	114
Pittsburgh	504	526	.....	.....	.....
Providence	280	335	.....	.....	.....
Paterson	400	.....	.....	.....	.....
Rochester	245	.....	.....	.....	.....
Reading	355	.....	.....	.....	.....
Utica	449	.....	.....	.....	.....
Washington	637	387	.....	.....	.....
Worcester	306	.....	.....	.....	.....

The eight offices working on the "multiple" system average 623 connections per operator. The remaining fourteen, using "straight" boards average 309 connections per operator. Although New York, Denver, Pittsburgh and Providence are making less connections per operator than a year ago, it would appear that the majority of the exchanges are getting more work out of their operators than formerly.

Remembering the discussion upon Mr. Carty's paper at the Providence meeting, as to the number of calls that could be answered by one operator in a day upon the multiple boards, it is interesting to notice that New Orleans reports 1054 as their operators' average day's work.

Table No. 6 indicates the number of wires allotted to each subscriber operator.

TABLE NO. 6.

SUBSCRIBERS' WIRES PER OPERATOR.

Exchange,	1886.	1885.	1884.	1883.
Baltimore	67	71	85	30
Boston	88	63	.....	.....
Brooklyn	72	71	68	48
Buffalo	57	70	67	67
Camden	69	.....	.....	.....
Chicago	37	33	34	31
Denver	48	.....	.....	.....
Detroit	71	70	.....	.....
Jersey City	87	.....	.....	.....
Lowell	37	.....	.....	.....
Louisville	70	.....	.....	.....
Milwaukee	71	91	64	46
New Orleans	142	144	.....	.....
New York	91	.....	66	.....
Pittsburgh	62	65	.....	.....

SUBSCRIBERS' WIRES PER OPERATOR—*Continued.*

Exchange.	1886.	1885.	1884.	1883.
Providence	35	35		
Paterson	91			
Richmond	128	108	88	
Rochester	50			
Reading	44			
Utica	100			
Washington	79	126		
Worcester	34			

Eight multiple boards average 81 wires per operator; fifteen "straight" boards average 65 wires per operator.

Let us next look at the cost of making connections, which will be found in Table 7.

TABLE NO. 7.

COST OF CONNECTIONS.

Exchange.	Cost of one Connection.				
	1886.	1885.	1884.	1883	1882.
Baltimore	.0045	.0025	.0040	.0058	.0072
Boston	.0166	.0038			
Brooklyn	.0040	.0041	.0069	.0098	
Buffalo	.0057	.0064	.0060	.0047	.0072
Camden	.0720				
Chicago	.0056	.0048	.0054	.0064	.0073
Denver	.0061				
Detroit	.0016	.0021			
Jersey City	.0050				
Lowell	.0063				
Louisville	.0033				
Milwaukee	.0035	.0046	.0113	.0055	
New Orleans	.0011	.0015			
New York	.0083	.0066	.0066		
Pittsburgh	.0035	.0051			
Paterson	.0050				
Rochester	.0060				
Reading	.0020				
Utica	.0035				
Washington	.0031	.0051			
Worcester	.0073				

Baltimore, Boston, Chicago and New York all pay more for connections than they did a year ago. On the contrary, Buffalo, Detroit, Milwaukee, New Orleans, Pittsburgh and Washington have reduced the cost.

The reports showing the time of making ten consecutive connections have, I am aware, always been received with a degree of scepticism, still with the care-

ful instructions given last year and repeated this year, it would seem as if the results obtained should be considered authentic.

While naturally desirous of making good time, it is not to be believed that any member of this Association would intentionally falsify the record, and the table given below is therefore worthy of considerable confidence.

TABLE NO. 8.

TIME OF CONNECTIONS.

Exchange.	1886.		1885.		1884.		1883.	
	1 office.	2 offices	1 office.	2 offices	1 office.	2 offices	1 office.	2 offices
Baltimore	2.54	.....	3.27	.....	.....	.....	.....	.....
Boston	3.02	7.52	2.20	12.5	.....	.....	.....	.....
Brooklyn	5.32	7.05	4.49	6.47	10.45	10.45	10.	12.
Buffalo	3.30	5 15	3.20	5.05	6.	8.15	7.	9.30
Chicago	11.30	14.00	7.	8.	7.05	11.38	10.50	14.36
Detroit	3.13	5.36	3.05	8.	.....	.....	.....	.....
Jersey City	4.30	8.01	.....	.....	.....	.....	.....	.....
Lowell	4.20	6.23	.....	.....	.....	.....	.....	.....
Louisville	7.30	8.30	.....	.....	.....	.....	.....	.....
Milwaukee	5.40	.....	4.48	.....	4.15	.....	9.	.....
New Orleans	2.30	.....	.....	.....	.....	.....	.....	.....
New York	3.	5.	2.20	3.40	.....	.....	.....	.....
Pittsburgh	10.30	10.42	10.31	10.42	.....	.....	.....	.....
Providence	3.15	9.45	14.	.....	7.50	12.	9.10	14.20
Paterson	3.15	5.16	.....	.....	.....	.....	.....	.....
Reading	8.	12.	.....	.....	.....	.....	.....	.....
Washington	2.44	.....	.....	.....	.....	.....	.....	.....
Worcester	6.45	13.20	.....	.....	.....	.....	.....	.....

As would naturally be expected, the best time is shown by exchanges using the multiple board, Washington, Baltimore and New Orleans leading the list in the order named, although several offices using the "straight" board are not far behind.

Cincinnati, whose record last year excited comment, makes no report this year, and leaves Chicago as the "tail-ender," with a record of eleven and a half minutes for ten connections through one office, Pittsburgh's multiple board being only one minute faster.

Certain features of this table furnish material for contemplation, as, for instance, the record of the Providence Exchange, which in 1885 took fourteen minutes to accomplish the result, this year attained in three minutes and a quarter.

Table No. 9 shows the number of trunk lines.

TABLE NO. 9.

NUMBER OF TRUNK LINES.

Exchanges.	1886.	1885.	1884.	1883.	1882.
Baltimore	17				
Boston	183	152			
Brooklyn	175	126	104	89	
Buffalo	57	45	37	26	21
Camden	30				
Chicago	366	355	254	245	228
Denver					
Detroit	30	20			
Jersey City	67				
Lowell	12				
Louisville	2				
Milwaukee					
New Orleans					
New York	600	520	491	331	274
Pittsburgh	47	39			
Providence	32	37	42	38	48
Paterson	26				
Rochester					
Reading	5				
Utica					
Washington	5				
Worcester	8				

This table shows that the number of trunk lines is increasing year by year, but by Table No. 10 we shall find that the daily use of such lines does not seem to have increased over last year, except noticeably in the case of New York.

TABLE NO. 10.

TRUNK CONNECTIONS.

(Daily Connections per Trunk.)

Exchanges.	1886.	1885.	1884.	1883.	1882.	1881.
Baltimore	16					
Boston	27	24				
Brooklyn	25	33	22	28		
Buffalo	26	36	39	50	41	21
Chicago	61	56	38			
Detroit	61	52				
Jersey City	13					
Lowell	14					
New York	56	48	31	41	31	23
Pittsburgh	74	111				
Reading	4					
Washington	18					

Table No 11 exhibits the capacity of the cord and plug switch-boards in use in the reporting exchanges, and indicates how rapidly the cord board is supplanting the plug.

TABLE NO. 11.

Year.	Cord.	Plug.
1886	34,190	9,235
1885	46,985	15,110
1884	38,070	23,418
1883	21,432	12,763
1882	16,799	12,755
1881	8,893	11,904

Table No. 12 shows the proportion of "direct" and "circuit" wires by which the different exchanges connect their subscribers.

TABLE NO. 12.

DIRECT AND CIRCUIT WIRES.

Exchange.	1886		1885	
	Direct.	Circuit.	Direct.	Circuit.
Baltimore	1,007	404	831	382
Boston	1,769	36	1,606	44
Brooklyn	2,157	195	1,734	237
Buffalo	1,185	183	1,102	165
Camden	194	12	185	10
Chicago	4,067	.....	3,630	.....
Denver	717	9	715	10
Detroit	1,821	189	1,605	156
Jersey City	385	131	350	127
Lowell	32	227	52	221
Louisville	675	372	730	271
Milwaukee	1,172	104	986	112
New Orleans	995	73	975	84
New York	6,004	6	5,213	6
Pittsburg	1,457	205	1,120	173
Providence	340	944	324	616
Paterson	441	92	459	94
Rochester	479	185	362	163
Reading	145	184	147	233
Utica	525	25	.....	.....
Washington	444	270	292	314
Worcester	78	192	88	185
Total	26,089	4,038	22,506	3,603

Twenty-one exchanges reporting last year and this show 4,013 circuit wires, and 25,564 direct wires this year, as against 3,603 circuit and 22,506 direct

wires last year. The proportion of circuit wires is only slightly less this year. The most noticeable feature of this table is the great preponderance of circuit wires in the New England exchanges, and the fact that Louisville appears to have increased the number of its circuit wires and reduced the number of its direct wires.

The great exchange of New York has only 6 circuit wires, but Chicago is the only exchange showing a clean score of nothing but direct wires.

It may be interesting to note in the next table the average salary paid to operators. Fifteen of the largest exchanges are used to figure from, and each manager can note for himself whether he is above or below the average.

TABLE NO. 13.

SALARIES OF OPERATORS.

Fifteen Exchanges—745 Operators.	Weekly Salary.
Highest (including Chief Operator)	$23.75
Lowest	2.33
Average	6.61

New York appears to pay the highest average salaries to operators, viz,, $13.13 per week, and Milwaukee the lowest, $4.95.

Now let us glance at the wages paid to outside men.

TABLE NO. 14.

SALARIES OF LINEMEN AND INSTRUMENT MEN.

Fifteen Exchanges—119 Men.	Daily Pay of		
	Line Men.	Instrument Men.	Combination Men.
Highest	$2.88	$3.84	$2.50
Lowest	1.25	.76	1.53
Average	2.08	1.84	2.06

New York again pays the highest average wages, Baltimore the lowest, to linemen, and Worcester the lowest to instrument and combination men.

In conclusion, I have only to say that uninteresting as these statistics may be to listen to, they form an exceedingly interesting study when printed with the proceedings. Were complete returns made from every company in this Association the figures would still be of greater interest and value, and it is earnestly to be hoped that whoever shall compile the statistical report for next year's meeting, may have the satisfaction of so doing from reports representing the whole business of the membership of this Association, which is practically the entire telephone business of this country.

C. H. BARNEY,

Secretary.

THE CHAIRMAN—If there is no objection the report of the Secretary on "Statistics" will be received and filed, and printed, as is usual in such cases. Mr. Lockwood, are you prepared to read your paper?

MR. LOCKWOOD—Yes, sir, if it be the pleasure of the Association.

THE CHAIRMAN—If it is the pleasure of the Association, we will listen to the reading of Mr. Lockwood's paper on the subject of the "Protection of Switch-boards."

MR. SEELEY—I move you that Mr. Lockwood's paper be laid over until to-morrow morning. It is a very important paper and there are very few members here. They have gradually dropped out. I move that we adjourn.

MR. DURANT—If the gentleman will withdraw his motion, I would like to say that owing to the low stage of water we shall have to leave to-morrow promptly at two o'clock, and if members will kindly be on board at that time, we will cast adrift and get there in good season.

MR. FAY—I would say that we have a good deal to do and it is better not to adjourn. We had better push the business of the Association along as rapidly as possible.

MR. EASTABROOK—I would second Mr. Seeley's motion if he will add to it that Mr. Lockwood's paper be the first thing for to-morrow morning.

MR. SEELEY—I withdraw my motion.

MR. EASTABROOK—I move you that the reading of Mr. Lockwood's paper be postponed until to-morrow morning at 10 o'clock.

The motion was lost.

THE CHAIRMAN—We will now listen to Mr. Lockwood's paper.

MR. LOCKWOOD—I am not quite clear as to whether the subject of my paper will be acceptable to all; but it was a very difficult thing for me to choose a subject; and if it is not altogether acceptable in all its details, I hope that I shall find it out, directly or indirectly, and that hereafter, if the Secretary wishes me to prepare a paper, he will furnish me with a list of subjects that I can choose from.

Mr. Lockwood then proceeded with the reading of his paper, which was as follows:

ON THE NECESSITY OF PROTECTING TELEPHONE EXCHANGES, CIRCUITS AND APPLIANCES FROM THE DESTRUCTIVE EFFECTS OF INTENSE ELECTRIC CURRENTS AND DISCHARGES.

MR. CHAIRMAN AND GENTLEMEN—In the younger days of telephony and telephonic utilization, when we, *too*, were younger, to write a paper or an article upon the intricacies of the telephone, the central office, the signaling, and induction neutralizing appliances was for me an easy operation. I am sure that the majority of you will agree with me that it is a comparatively light undertaking to write an instructive article upon a subject of which we know little or nothing, and to dilate learnedly upon the causes, near or remote, of phenomena with which we only have a bowing acquaintance; but, as we and our business grow older, we grow more cautious about making assertions, and do not especially yearn to air our superficial knowledge; consequently, when in the palmy days of telephony, my pen was accustomed to scratch off from twelve to fourteen pages of foolscap per week, it was less of a task than it now is, merely to choose a subject to write about; and when I occasionally throw a retrospective eye over the statements which unscrupulous publishers have ascribed to me, I rather wonder on the whole that I made so few mistakes. I hesitated considerably before consenting to commit myself to a paper for the Association, and when our honorable Secretary asked me directly if I would furnish a paper, I am afraid that I only said, "I would try," from a constitutional disability to say no. Still we have it on the very highest authority—as General Butler would say—that "Fools rush in where angels fear to tread;" and after long and painful cogitation, I chose the subject with the long title which I have read to you—principally, I grieve to say, for the lamentably insufficient reason that upon looking over the Association records, I found, or thought I found, that it was as unhackneyed as any I could pitch upon, unless I switched off from the realm of applied electricity into "methods of book-keeping—toll *versus* lump-charge" or some other of those lay investigations of which electricians and electrical engineers are supposed to know nothing,

I have, in the title of my paper, referred both to intense electric currents and discharges. It may be said that the terms "currents" and "discharges" are synonymous. And, indeed, the difference is only one of degree, but for the purposes of this paper I have assumed a current of electricity to be an electrical excitement in a linear conductor of comparatively controllable force, so that it is actually dependent for its existence upon a circuit of some sort, and which consequently ceases to be, when that circuit is broken or impaired.

Per contra—I choose to regard a "discharge," or, more properly, a "disruptive discharge" of electricity as a form of electrical excitement which is not dependent upon the palpable continuity of a circuit, and which, as in the lightning flash, has a sufficient force of its own to leap an air space or to traverse an extremely poor conductor which may intervene in its direct and devastating career.

There is, I hope, little need that I should emphasize the necessity of protecting our circuits and apparatus from the destructive effects of these currents and discharges.

It would not be hard for me to believe that every exchange represented at this meeting, has directly or indirectly, in a greater or less degree, suffered from this cause.

When the business was in its first and second years, we heard little of damage and loss, fairly to be ascribed to abnormal electrical currents and discharges. The electric light then existed only in a sporadic state. As recently as July 4, 1876, it was counted a startling novelty not to be repeated hastily, to show an arc light upon the Western Union New York tower; and we were just beginning to hear of Brush, and to get a hazy idea that the Brush machine was so named, because, possibly, there were more brushes on its commutator than on the average machine, and that the Gramme machine owed its patronymic in some vague and unaccountable way to the centimetre-gramme-second system of units.

Even the summer lightning storm scarcely seemed at that early time to have acquired the prevalency, fierceness and the ability of getting in its work, that it has assumed of late years.

I imagine, however, that the immunity we then apparently enjoyed is to be ascribed, first of all, to the small number of exchanges, circuits and telephones in existence, and the probability is that, all things being equal, the mortality of telephonic appliances from this disease was not much less in proportion to the number of instruments in use than it is now. At that time, too, the battery transmitter was not so universally employed, and the magneto bell was not therefore so complicated in its switch connections, while the telephones, when not actually being used, were completely cut off from the circuit.

By the end of 1881, however, we began to ascertain by bitter experience that throughout the United States (with the exception of the entire city of Philadelphia) lightning was a factor among the destructive agencies at work against telephone plants which had to be counted upon. With respect to the remarkable exemption from disaster due to this cause enjoyed by Philadelphia, I am constrained, after careful consideration, to believe that it can only be ascribed to the existence of the same conditions which in ages gone by would have saved Sodom—to wit, the residence there of not less than ten righteous men.

The destruction of telephone apparatus at this period was quite noticeable, and, curiously enough, that portion of the apparatus which seemed to suffer the most heavily was the transmitter induction coil; and this seemed the more singular in view of the fact that this portion of the instrument was assumed to be in circuit only during the actual occurrence of conversation, and to be totally disconnected by the automatic switch during the long and frequent intervening periods of quiescence.

This was ultimately accounted for by the circumstance that the older magneto bells had but one binding screw for their local battery connection, and it was customary for the person connecting them to attach the other battery wire into one of the main line connection screws.

This, of course, left one end of the preliminary helix of the transmitter coil

always in connection with the line, and in the event of the line receiving a lightning discharge, a portion of it would frequently seek earth through the primary helix, and across the insulation to the secondary, burning both out in transit. The practice of connecting the battery wires in this fashion was very generally discontinued after this discovery, and the bells later were differently arranged, so that this danger was subsequently minimized.

By the beginning of 1882, electric light plants were fairly established in most of our large cities, and from that time to the present they have been a constantly increasing quantity. Very few cities of any importance are now without their electric arc light system, and as a natural consequence very few telephone exchanges are in a position to assume that they are not, and cannot be liable to a danger due to a cross between the two classes of conductors.

This source of dangerous currents has in fact completely overshadowed the older and more natural exposition of electrical fireworks, and it behooves us to look the danger in the face, to prepare for the catastrophe which may never come, and to prevent it, if possible.

Not that lightning does not even now scatter destruction along its path ; not that we must fear and guard against the lightning discharge less, but that we must look out for and guard against the adverse electric lightning current more.

Of course, every telephone exchange manager hopes and believes that everybody else's plant will suffer before the danger comes nigh him, but it is just as much a truism now as in the days of the wise but uxorious Solomon, that "the prudent man seeth the evil and hideth himself, but the foolish pass on, and are punished."

The Gaul, in his own habit of thinking, points a moral by the aphorism that " It is always the unexpected that happens," while the more calculating Teuton shows his views by the more cautious statement, " Then you must look oud."

We are not without examples of costly ruin in telephone property from the causes I am speaking about, and I think I am justified in believing that the instances made public are few in number, compared to those which have remained in obscurity, although, perhaps, more far-reaching in importance and more extensive in intrinsic value. Boston, New Orleans, Toronto and other places have had central offices gutted from electric light currents. Omaha has, I understand, suffered dreadfully from lightning, and the isolated cases where single subscribers' outfits have been destroyed and annunciator drops damaged, have even within my own limited observation been of great frequency. What, then, are we doing, or going to do about it ?

Were these places warned of the destruction before them ? Some of them were, to my certain knowledge, both by example and precept. I myself have lifted up the voice of warning to protect both ends of the telephone circuit ; and in one or two instances have been laughed at as an alarmist.

In the case of Boston, several small conflagrations took place, bells were burnt out, and sections of cable were destroyed, before the grand stroke came, but the warning was not taken, and the central office was burned.

The result was not altogether without benefit, for the central office in that city has, I believe, not a single wire entering which is now unprotected at the office

end, showing that its managers have at least in some measure profited by experience.

Again I ask, what are we doing, or what can we do to prevent or diminish destruction from these devastating influences?

With respect to lightning we cannot do much more than we are and have been doing for a long time. We should protect our central offices as far as possible, I think, by providing them with a high, projecting, and thick copper lightning-rod, stretching far down into the earth, not fastened to the building by little rings of glass in the style adopted by the peripatetic lightning-rod man, but stapled to the building itself, for it *is* possible that a discharge of lightning might find an opportunity, having struck the building, to escape by way of the rod; but it is not conceivable that a charge of electricity traversing the rod could be lightly induced to forsake good honest copper for bricks or wood. If any lightning can be found with such dishonest and illegitimate propensities, we may rest assured that little glass iusulating rings will exercise no restraining power on it. We should be liberal in the size of our ground wires, both in central and subscribers' stations. Too often the terminal ground at the end of a subscriber's line is nothing but a flimsy No. 18 S. W. G. copper wire, twisted three times around an unscraped gas pipe. We should insist upon better lightning arresters at the central station for each line. The best, I think, is a kind which I do not often see, namely, a form in which advantage is taken of the habit of high tension electricity to pass promptly from a point to a plate. Now, as my experience leads me to believe that damage is due to an equalizing discharge from the earth, about as often as from the direct stroke, I hold that both point and plate surfaces should be provided for both sides of the lightning arrester, so that discharge in either direction may be facilitated. Let us now consider the electric currents. Perfect security will only be achieved from dynamo currents when the electric light and telephone companies shall combine for the best interest of both; when both learn to see that a disaster to one is but in a less degree a disaster to the other; when the linemen of one company shall cease to regard the presence of another company's wires at any point or place as a personal insult, and as a sufficient reason for them to be elsewhere; when electric light companies will refrain from using wire unless it be insulated with an insulating material instead of with a covering only; and when telephone linemen will have no serious objection to going a foot or two out of the pre-ordained route, when they come near to an electric light or power wire.

Failing, however, to attain perfect security, the next best thing is as perfect security as we can attain.

To gain this, we require, first, a thorough grade of construction; we need also some efficient automatically operating protector, not only at the central office end of every line, but also one for each wire where the conductors emerge from the cable if an out-going cable is used. These precautions are to defend the cables and the central station apparatus.

What availeth it, however, if the central station and connecting wire are saved, if but one subscriber's station be destroyed; and if subscribers' stations are left unprotected who dare say, that even to-morrow, the powerful electric lighting current by some accident may not (and the more likely if the central

station end is fully protected) pass along the subscribers' line aud destroy his instruments, or what assurance have we, should such a thing happen, that the telephone instruments will be the only articles burned.

One fire caused by an electric light current entering a subscriber's house or office, if it should be at all serious, would be a worse blow to any telephone company than a dozen affecting the central office or conductors only. This is no vain caution. I have thought deeply of what I say, and I repeat that where the electric light wires parallel and intersect the telephone wires in our streets, that telephone exchange is barely half protected against the heating effects of electric currents, that has a protector at the office or cable end of each wire only.

This applies, of course, equally to private lines. Even while I am penning these lines, I am informed that a private line, leading out of this office, has had all four of its bells burned out; all of which might have been saved had each station been fitted with protectors.

If a cable occupies an intermediate position, its wires, in my opinion, require protectors at both ends of the cable. The question now arises—what form of protector is to be used? Two broad and comprehensive classes are more or less known, viz.: Those in which a coarse wire electro-magnet, included in the telephone circuit at the points to be protected, is used to break the circuit or shunt the instruments upon the passage of an abnormally strong current through the wires, the magnet being non-operative when the ordinary telephone or magneto currents are passing; second, those in which an attenuated strip of metal foil or wire is made to form a part of the circuit outside of the portion to be protected; this having a sufficient conductivity for the ordinary currents, but being adapted to burn out, fuse, volatilize or deflagrate when a dangerous current passes.

Both of these classes may again have diverse functions. They may, for example, be adapted to simply break the circuit, producing a space so wide that the current cannot overleap it, notwithstanding its great electro-motive force; or they may be adapted to open the circuit, and then to put one or both of the severed ends to earth, for the escape of the electricity. Each have their weak and their strong points.

Protectors depending for their action upon electro-magnets are reasonably sure in their action, and are prompt, because the magnetizing effect of a current is swifter than its heating effect. On the other hand, electro-magnets in telephonic circuits interpose a much higher opposition to the passage of the telephonic currents than might be expected from their resistance only, by reason of the counter currents generated in their coils by the changes in their magnetism.

MR. LOCKWOOD—(Speaking).

I might well interpolate here, that there is a remedy by which electro-magnets may be intercalated in the telephonic circuit without exercising this pernicious effect, if the electro-magnets are connected in what we call multiple arcs, that is, if the line wire be brought abreast—be divided into two parts and brought abreast—one branch to one

magnet, and the other branch to the other magnet, and led through each magnet coil individually, and then joined on the other side and laid on as usual—to put it in plain language, connected abreast instead of connected in tandem. The counter-current has a short circuit through those coils, and does not materially affect the passage of the telephonic current; and although I had not written this, the sight of Mr. Wiley Smith here, who has always been an advocate of that method of connection, reminded me of it at this time.

Electro-magnetic appliances, irrespective of their simplicity, are necessarily higher in first cost than are the fusible protectors. It is proper, however, to state here, that magnets of such low resistance as are required for these appliances are not extremely troublesome in the first respect.

It is rather remarkable that one of the first lightning arresters used in connection with telegraph lines in the United States consisted of a coarse wire magnet, through which the main circuit led to the regular instruments, and which was provided with an armature and contact points; the armature was connected with a branch wire leading from the circuit wire and ordinarily open, and the fixed contact point was united to a ground wire. When a heavy discharge of lightning came along the magnet was for a moment vitalized, and attracting its armature, connected the line instantly, but temporarily, to earth, thus discharging the line.

This was devised by Mr. J. D. Reid, who is still, I believe, connected with the Western Union Telegraph Company.

The most effective appliance of this class, in my opinion, is the simple arrangement invented by Dr. S. M. Plush, General Manager of the Philadelphia Bell Telephone Co., and comprising a small electro-magnet mounted on an insulating base; this is provided with an armature as usual, and the armature has a lever ending in a catch, which when at rest holds a spring lever in place. The circuit is led through the magnet coil, armature lever and spring lever, so that when the armature is attracted the spring lever is liberated and flies back, leaving an opening of some six or seven inches in the circuit, and preventing damage to the instruments inside of the safety appliance. I have heard nothing but good of this appliance. It is extensively used in Philadelphia, and I regard it as being a very efficient protector indeed, and its first failure has yet to be heard of.

The worst thing that can be said of it is that after one is opened it has to be manually attended to before the circuit can be used. Like all other electrical appliances, it requires to be well made to give good work.

Other electro-magnetic devices have been invented of various kinds and for various auxiliary purposes; for example, one is so arranged that it grounds the circuit through contact points as long as the dangerous current is passing, and restores the original state of things when the danger is over. This is done by winding the magnet with two wires, a coarse and fine one, as in the Brush lamp; both wires are at first in the circuit, but the arrival of a dangerous current excites the magnet core first by an increased current in the fine wire, and then

by the coarse wire coil, and attracts an armature that remains irresponsive to the telephonic currents ; when this armature is fully attracted it shunts the fine wire coil and grounds the line and the instruments until the danger is over, when the armature spontaneously falls back, restoring the normal condition. The use of the fine wire is to excite the core and operate the armature, even though the current be not sufficiently high to operate through the coarse coil at first. Still another form uses the end of the iron core as the ground contact. Another combines this general form of protector with an electric bell to indicate the occurrence of danger audibly.

My own idea is, however, that appliances for the purpose cannot be too simply made, and that we, as a rule, multiply complication in direct ratio to the multiplication of functions.

Referring again to the fusible link protectors : it is no new idea to use fusible wires and strips as lightning arresters.

But they were not readily adapted to telephony. These, too, have their own vices and virtues.

They are, for example, too susceptible to even the smallest lightning storm ; for after every storm a number have to be replaced—that is, if tin-foil be used. The tin-foil protectors are also somewhat difficult to mount, so as to make a good connection with the line wire, and it is not an easy matter to provide just the thickness and width of foil that will fuse or give way with currents which are of medium intensity, and these currents are the most dangerous, because, with them, the wires heat gradually, and are liable to keep the insulation of the wires just at a smouldering heat for a long time before they finally break into a blaze.

Yet fusible links are cheap ; they cannot generate counter electromotive forces, and, if mounted by the manufacturer into a complete appliance, prior to attachment, they are easy to attach.

It must be remembered that fusible protectors need not necessarily be made of tin-foil. Lead-foil or wire, or fusible alloy strips can and have been used. Very fine wires, say about No. 40 of iron, and German silver, have been used ; and it is matter of history that the New Orleans exchange, as early as the period when it was managed by W. H. Bofinger, employed platinum wire protectors not only at the central station, but also at the subscribers' end of the line; so many differing and adventitious circumstances enter into individual cases, that it is impossible for me to say, arbitrarily, that tin-foil is better than fine wire, or *vice versa*. One dynamo, for example, may be a forty lamp, another a twenty lamp, and still another a ten lamp machine ; and a wire of high resistance which would instantly volatilize with the first machine might not even redden with the last. The main point which I desire to accentuate is, recapitulating the subject of my paper : " The necessity of protecting telephone exchanges, circuits and appliances from the destructive effects of intense electric currents and discharges." The necessity of some form of protection, whether it be electro-magnetic or fusible, and the equal necessity of protecting both ends of the circuit with equal diligence and care.

This much may be said in favor of the fine wire (and for the material I prefer German silver), that it is easier applied than any other form, all the essential

features being two screws, a pair of copper burrs on each, and about five inches of fine wire twisted round each screw. I have no objection, also, to say that my own personal preference is for a well-made Plush Electro-magnetic Protector.

I think a few words on the question whether it be best to *open* a circuit, crossed with an electric light wire, or whether it should be grounded by the action of the protector, may not be amiss.

While I believe the first thought of most persons would be to ground the circuit, I believe also that the sober second thought would be in favor of opening. For these reasons, the circuit, once opened, is innocuous; the current, so far as that line is concerned, has softly and suddenly vanished away, like the gentleman who hunted a snark and found it a boojum, and it is in fact *non est*.

But if the protecting appliance act to ground the circuit, or merely to shunt the instruments, not only is there likely to be a dangerous spark and flash at the contacts, but the current is still there; there to complete its murderous and incendiary work, the first chance it gets: there to pass on to the next station, and to repeat its wayward performances. There is, furthermore, another point we cannot overlook; placing a grounding appliance upon our circuits may, if it comes into action, endanger the life and health of the dynamo machine itself by short circuiting, and thus render still more untractable the already uncanny electric light man.

During the last three or four years a great number of protecting appliances have been patented, and a great number of promoters and organizers have tried to organize stock companies based upon the merits of this protector or that protector; of course, with the object of selling the stock, and then looking for other worlds to protect. These companies are good things to fight shy of. There is not enough, even in a meritorious protector, or in a meritorious individual signal instrument, to found a stock company on, and I have seen the rise, decline and fall of many such organizations.

There is still another feature of this subject which needs attention. This is the line wire itself. The telephone line should not be supported near the electric light wire; it should rather be strung over a circuitous route. Where the telephone wire crosses or is crossed by electric light wires it is a good idea to encase it in a split tube of wood or like material, the two halves being fastened together by screws or wires. This simple precaution may prevent a serious loss.

I hope I have laid this subject forcibly before you. There is no telephone company so poor that it cannot at least afford the simple wire protector; none so rich that it can afford the loss of its own central station or the store or office of its patrons. No telephone manager should, in my humble opinion, be satisfied with less than the best. It may be that all the exchanges of all the licensees of the American Bell Telephone company are already fitted with protectors; I sent out no letters of inquiry, because I have before this year been upon committees and I know the general futility of such inquiries; still, I could wish that such a satisfactory state of affairs existed. I fear, however, it does not. If, then, this paper gives rise to serious thought upon the subject, I shall be repaid for the labor I have bestowed upon it and for the pain which I sympathetically suffer, in inflicting it upon you.

I will conclude by stating that I looked through the published proceedings of this Association before writing this paper, and found that there was nothing exactly like it before; but I may also say, that it well repays anyone to frequently re-peruse these proceedings, and that one who has only read his annual copy once, and has then shelved it, will be surprised to find the immense amount of information and detailed experience which is embodied therein.

Since the above was written I have become more firmly impressed with the idea that the tin-foil protector is not as well adapted even for the subscribers' station as it is for the central stations. We have just passed through the summer season, and it is true, although 'tis also a pity, that not a lightning storm can occur or has occurred in Boston without disrupting a great number of these protectors.

This effect is bad enough at the central station, but would be much more troublesome occurring at a number, say fifty subscribers' stations simultaneously, and for this reason I am disposed to believe that an electro-magnetic protector that opens the circuit will generally be more satisfactory than a foil protector.

THOMAS D. LOCKWOOD.

After concluding the reading of the paper, Mr. Lockwood said: I should like to add just one or two words before any discussion takes place. Of course not every city where there are telephone exchanges, or even large telephone exchanges, has many electric light wires. I have, for example, just returned from Kansas City and was struck there with the comparative fewness of electric lights, and in such a place as that it hardly seems necessary to carry the proteetion business out to its fullest extent. Of course, if an electric light wire does not run anywhere near the telephone circuits it hardly seems worth while putting expensive appliances or even cheap appliances upon those circuits. But even in those cases, I think it is the part of wisdom to have inspectors and other employees of the telephone company keep their eyes open all the time, so that when the necessity for such protection arises it should be promptly applied.

THE CHAIRMAN—You have heard the very able paper of Mr. Lockwood, on the subject of the protection of switchboards. What action will you take?

MR. EASTABROOK—I move that it be spread on the minutes of this Association, and that our hearty thanks be rendered Mr. Lockwood for his painstaking and able paper.

The motion was carried.

THE CHAIRMAN—Mr. Lockwood, on behalf of the Association, I tender you its thanks. Does any gentleman wish to make any remarks? The hour of adjournment has arrived.

MR. EASTABROOK—The committee on Charleston wish to report progress. They have already received $235.

MR. LOCKWOOD—I simply wish to express my personal desire that the gentlemen present to-morrow morning will discuss the paper as freely as they may desire. I think it is a subject that the more we know about the better posted we shall be and the better able to defend ourselves.

The meeting then adjourned till the following day.

SECOND DAY'S PROCEEDINGS.

WEDNESDAY, September 8th, 1886.

The Association was called to order at 10 A. M., President Fay in the chair.

THE PRESIDENT—We left off last night with the reading of Mr. Lockwood's paper on protecting exchanges and instruments against the effect of heavy currents. Are there any remarks to be made on that paper, gentlemen?

MR. EASTABROOK—Before proceeding, the Charleston Committee desire to announce that they will be in session until adjournment this afternoon, at which time a remittance will be made by telegraph to Charleston.

MR. SEELEY—I would like to ask Mr. Lockwood a few questions about the Plush lightning arrester. Mr. Lock wood seems to think that that is the best lightning arrester. Is it not a fact, Mr. Lockwood, that when a lightning arrester is in circuit with a telephone wire, that whenever

the telephone wire becomes crossed with a heavy battery wire, the lightning arrester is operated by leaving the line open? We are using the Vail lightning arrester—a fusible metal device, which has given us entire satisfaction, so far. I think that in large cities the Plush lightning arrester would be inoperative, on the score of heavy battery wires getting across the telephone wires.

MR. LOCKWOOD—The question of Mr. Seeley is a very natural one under the circumstances. In the first place, it is partly a question of winding the wire. If the wire is wound sufficiently coarse, it may be quite responsive to electric light currents, while it may be sufficiently non-sensitive, if I may use the term, to be irresponsive to heavy battery currents. With the improved construction of the present day, which prevails in New York, in Mr. Seeley's jurisdiction, I am quite sure that that will not be a very frequent trouble. I wish to say that I have no preference for Dr. Plush's protector, except that I know it is an absolute protector when the dangers which I describe occur.

MR. SEELEY—I would like to ask Mr. Hall if he can give us a little information on lightning arresters. He has had a great deal of experience this last year with long wires.

MR. E. J. HALL, JR.—All our mechanical work has been done under the direction of Mr. Doolittle, and I think that he could explain to you perhaps better than I, what we have done.

THE PRESIDENT—Is Mr Doolittle in the room? If not, Mr. Hall, we have not much time, and had better go on as fast as possible.

MR. E. J. HALL, JR.—We make no attempt on our long lines to protect against electric light currents. What we use is simply a fine insulated wire wrapped around a ground, so that when the current passes through, the fine wire will be burnt off. We have the point arresters in some places, not in all.

MR. LOCKWOOD—Mr. Keller has had, I think, a larger experience with the tin-foil protector than any other representative here. It would, no doubt, be interesting if he would give us a little of his experience in the matter.

MR. KELLER—We are using, Mr. President, the strong current protectors, not only in Boston, but in a number of our other exchanges throughout New England. They are giving us very good results, so far as protecting us from the strong currents of electric light and power wires is concerned; but as for lightning we have a great deal of difficulty. Every time there is a storm a great many of them are destroyed; that is, the tin-foil is burnt out. We are not using them at the subscribers' stations at all—simply at the ends of the cable and in our cupolas. As I said before, they are giving very good satisfaction in that direction. But as for protecting against lightning, they protect us too much.

MR. LOCKWOOD—Was there not, Mr. Keller, some trouble with some of them that they did not respond sufficiently readily to medium currents?

MR. KELLER—Yes, in the first ones there was; but since our electrician, Mr. Farnham, has re-arranged the tin-foil and made it lighter in one particular spot, we have had no trouble from that source.

MR. LOCKWOOD—It is now made a great deal lighter at the centre.

MR. METZGER—For the benefit of the Association, I desire to say that in Pittsburgh we are using gold-foil paper, which we put in between the two binding screws, about four inches apart. This gold-foil paper has proved, so far as protection to the exchanges is concerned, a perfect success. Two weeks ago we had a heavy storm, and we had sixty-eight of them burnt out in about half an hour, and all by contact with electric light wires. So far as our switch-board and our office cables were concerned they were protected in every instance. It is a very cheap method.

MR. LOCKWOOD—Do you use it at both ends of the line?

MR. METZGER—No, sir; only at the central office.

THE PRESIDENT—It is very evident that the Pittsburgh Exchange is one of the gilt-edge concerns of the country. If there are no further remarks, gentlemen, we will hear Mr. Storke's paper on legislation. I would say, that I desire to hasten the discussion as much as possible, without unduly

curtailing it: We wish to press our business along this morning as far as possible.

Mr. Storke then read the following paper :

LEGISLATION.

I have received brief reports from nearly all the States in which laws affecting telephone interests have been discussed before the Legislatures. In but few cases have copies of the acts proposed been sent me, but the forms assumed by the various attempts to limit our charges and tax or regulate our business, are so nearly alike that it is not necessary to specify each particular bill. To say that a rate bill is based on the Indiana law conveys a sufficiently clear idea to the telephone mind. That has proved so disastrous to the business, and so serious an inconvenience to the public in that State, as to prove, I trust, a warning to other Legislatures contemplating similar action, and a spur to all interested in the business to see that every possible step is taken to educate the public mind and correct the false impression so generally prevalent as to the profits derived from telephone service furnished at $4 or $5 per month.

Other forms of attack have been in the shape of special taxation on our property or for license. Bills have been proposed for Commissions similar to Railroad Commissions, whose duty it is to regulate charges and see that no undue exercise is made of our rights as common carriers.

Underground legislation has made little progress since the last report. In all the larger cities experiments are being made by the telephone companies, in their own interest, and it is certain that, so soon as a practicable and economical system can be devised, that the main routes in cities of the first class will be buried. Interference legislation, compelling this to be done in advance of proved and tested facilities, is a mistake, and I think is not likely to be general.

It is proper here to say that, as far as I know, telephone companies have had little to complain of in the way of enactments relating to their duties as common carriers, or aimed to reach their property for assessment and taxation. These, in the main, have been fair, and under them our interests are probably as well protected as those of other corporations.

There is a feeling among telephone people that they are the object of special attack, and that there is a particularly strong prejudice against their business. This is in a measure true, but I imagine it is felt more deeply, because it is our ox that is gored. Telegraphs, railroads, banks and financial institutions of all kinds are just now the object of similar attack, and we are not perhaps greater sufferers than others.

Speaking for the companies in which I am interested, covering a large area of scattered territory, and operating thousands of miles of line along the highways and country roads of New York, I can say that at the start we were generally received with kindness by the public we were trying to serve. Aid was extended in many ways, rights of way secured and tickets purchased to promote the construction of our toll lines to an aggregate of more than one hundred thousand dollars. Until a comparatively recent period this kindly feeling was almost universal, and that it has been succeeded by the existing prejudice and ill-

will is due, I think, largely to the popular feeling against monopolies, as well as to the impression that enormous and undue profits are made by the telephone companies. The exaggerated statements of earnings under the Bell patents made by the Pan Electric and other infringing companies have had much to do with this, and the profits of the parent company in Boston have also been used as an argument against us.

MR. STORKE (interpolating)—Before the decision in New York, which stopped all work of that kind, we had an Overland exchange in active operation in Utica, N. Y. They had a list of 300 subscribers. They collected no money, but the promoters of the scheme circulated the statement, which was almost universally believed, that the Central New York Company was paying regular dividends of 5 per cent. a month, and had from the start. The facts are that the Central New York Company has paid no dividends in cash since the 1st day of April, 1884, and no dividend of any kind since October of that year.

Notwithstanding existing prejudices and the use made of isolated instances of profit, the situation remains practically where it was a year ago. The Indiana experiment is the only one yet made, and the results in that State would not seem to encourage similar interference with the laws of trade elsewhere.

By furnishing the best attainable service, by extending our facilities, and in every way accommodating the public, we can do much to allay the feeling against us, and avert the evils which have fallen upon our associates in Indiana. Where contract relations hamper us in doing this, and at the same time receive a reasonable return on our investment, we have the assurance of the parent company that they will be modified in this interest, which is in the interest of the whole business.

The following is a *résumé* of the information furnished by the officers of the various companies who have responded to the request of the Secretary.

The Legislatures of Maine, New Hampshire and Vermont did not convene last winter.

In Massachusetts strenuous efforts to regulate telephone rentals were made; a general law was proposed, placing all telephone and telegraph companies under State supervision; also a special law placing them under the supervision of the Railroad Commission. There was also some agitation before the Committee regarding compulsory legislation, for placing all wires under ground. These measures were all reported adversely by the Committee, but were called up later in the legislative halls. The rate bills were brought up in the House of Representatives and defeated by a large majority. The bills for State and Railroad Commission supervision originated in the Senate, and there died.

In Rhode Island no telephone legislation was attempted.

In Connecticut the only bill affecting telephone interests was one to reduce

rates, which died a natural death. It was regarded as purely an individual attack without backing from public sentiment in that State.

In New York rate and commission bills were introduced, both in the House and Senate, but failed to become laws.

In New Jersey no laws affecting telephone interests have been passed. A three dollar rate bill was fully discussed before the Committee and defeated.

A bill affecting long distance companies was introduced, but afterward withdrawn. Its object was to interfere with the right of the long distance companies in leasing offices in connection with any local company.

A substitute for a bill compelling the companies to bury their wires, permitting them to acquire underground rights, was introduced, but not passed.

The Pennsylvania Legislature did not meet last winter.

In Maryland no laws were enacted.

In the territory of the Southern Bell Telephone Company, covering the States of Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida, no bills have been introduced affecting telephone interests.

In Kentucky the situation is clearly stated in the following extract from a letter written by General Manager H. N. Gifford, of the Ohio Valley Telephone Company:

"With the exception of an act granting a special charter to the Ohio Valley Telephone Company, and an act amending an act for the protection of telegraph lines in the State of Kentucky so as to include telephone lines, which in fact makes it a misdemeanor, punishable by fine or imprisonment, or both, to maliciously injure or interfere with any telephone lines or poles in the Commonwealth of Kentucky, there was no legislation at the last session of the Legislature relating to telephone interests.

Two rate bills were introduced in the Senate and two in the lower House. One of each were copies of the Indiana law, the other two similar with a slight modification.

These bills were referred to different committees, but, fortunately for us, all these committees were composed of intelligent progressive men.

Three of the bills were never reported from the committee; one was reported by mistake and was referred back the next day, and none of them ever came up before either House for passage. It is not likely they would have passed even had they been reported, as the members of both Houses devoted more or less time to investigating the results of the Indiana law passed the year before, and a large majority were convinced that the law was both unwise and unconstitutional."

The Legislatures of Arkansas, Minnesota, Texas and Dakota did not meet the last winter. In Ohio the Indiana bill was introduced, but defeated.

H. L. STORKE.

THE PRESIDENT—Gentlemen, you hear Mr. Storke's paper. What is your pleasure?

MR. METZGER—I desire to correct the statement in regard to Ohio. The bill was introduced, went before the

Committee, and then, subsequently, was brought up in the House. It was laid over until January of next year.

MR. STORKE—I would say that I have spoken of bills as being defeated, whether they were actually defeated in the House or before Committees. But in the Ohio case it was simply a postponement.

MR. METZGER—Simply a postponement to 1887.

THE PRESIDENT—Is Mr. Hockett in the room? I think that the Association would be very much pleased to hear from him a statement of the results of the law in the State of Indiana.

MR. HOCKETT—I do not know that I am qualified to give you a statement that would convey that information.

THE PRESIDENT—Can you not tell the effect within your territory?

MR. HOCKETT—The effect has been, so far as I know, that the exchange business has had to be discontinued in the larger places, and in its stead a telegraph system or toll system adopted, making a charge for each message.

THE PRESIDENT—Is the result of the attempt to establish the tariff system, satisfactory to the telephone company?

MR. HOCKETT—I could not answer that question.

THE PRESIDENT—Do you know what the result has been in Evansville?

MR. HOCKETT—I know only from newspaper reports. That is not in our territory.

MR. CARSON—How do you work the system in Indianapolis?

MR. HOCKETT—We work it on the toll plan, five cents for each connection.

MR. CARSON—Do you charge five cents for every call that comes from a station?

MR. HOCKETT—Yes, sir.

MR. STORKE—That is, after you get the nickel in the box, you do not have an arrangement for taking it out again?

MR. HOCKETT—We do not have that plan. We keep a record of the number of connections.

MR. SEELEY—What is the average receipt of each one of those pay stations per month?

MR. HOCKETT—I have kept no record of that.

MR. STORKE—The answers which have been received from the gentleman who has just retired from the floor, correspond a good deal with the answers I have received to my inquiries in other directions. The best answer that I have been able to get to a great many questions has been, "I don't know," or, "I don't remember."

MR. LOCKWOOD—There was a gentleman on my right side just now, who, I have no doubt, is eminently qualified to speak on this subject, being both a responsible party and having some Indiana territory. I refer to Capt. Gifford.

MR. GIFFORD—I can understand all about friend Hockett. I saw him on the witness stand several days, and he is the most uncommunicative man I ever saw, except Wiley Smith.

Our license—that of the Ohio Valley Telephone Company—covers only two counties in Southern Indiana, the counties of Floyd and Clark, and in those counties are the towns of New Albany and Jeffersonville. In New Albany we had an exchange of 120 subscribers, and in Jeffersonville we had an exchange of 50 or 60. When the $3 law was first passed, I notified our subscribers that we could not comply with its requirements without losing money. Most of them (there were a few exceptions) but most of them saw the point, and were perfectly willing to pay the old rate under the new form of contract, similar to the one prepared by the Central Union Company, that was signed July 1st, 1885, by which they agreed to pay the old rate, and we agreed to refund the excess over the legal charge, provided the decision went against us in the State Courts of Indiana. Everything went well for two months. A little constable out there found there was a penal clause connected with that bill, and the first thing we knew we had 134 suits slapped on to our manager. He was arrested. I went over and arranged for his bail, and let the poor fellow out. But we did not collect any more bills. I let the accounts run on until the decision, and then I immediately notified our subscribers that we could not con-

duct business at that rate without losing money, and we availed ourselves of a very peculiar clause in the decision, to the effect that we might discontinue business if we wanted to. We could continue the business we had and not take new business, or we could, if we chose, discontinue any particular line. I took advantage of that clause, and notified them that we would discontinue the business. I had some trunk lines over there. New Albany and Jeffersonville are tributaries to Louisville, and there are several large manufacturing institutions over there. The subscribers there were exceedingly exercised about it. I told them I would hook them up four or five on a line, and of course we did not want to lay ourselves liable to prosecution. I charged them simply the legal rate, two and a half or three dollars, and then charged them ten cents for every call over the river. I have between thirty-five and forty subscribers of that kind now. They are intelligent gentlemen. They see the point, and I have no doubt they would participate actively in a movement to secure the repeal of the law. We have a Wallace fellow over there talking about organizing a company, and we have the Brown people there. The woods are full of them, but the intelligent portion of the community understands that it is the Bell telephone or nothing. They are perfectly satisfied with our charges; in fact, they are satisfied with our *old* charges. The present arrangement is unsatisfactory to us, and it is unsatisfactory to them. We are making no money and they are getting a second-class service. We formerly charged $48 a year—$4 a month—and then had a toll charge of eight cents a call. We never made a cent out of it, even at the old rate, and, of course, we are losing money now. We are running it simply as an accommodation to those manufacturing establishments. They are connected with part of the Louisville Exchange. There is now no exchange in either of the Indiana towns I have mentioned.

MR. SARGENT—I think that perhaps Mr. Hovey could give us some information about Indiana. I understand he has been on the ground there. I should like very much to hear a word from him.

MR. HOVEY—What I know in regard to the Indiana matters, I know simply because I have been there attending to some other business not immediately connected with the results of the legislation in Indiana, and I know of these results simply because they have come to me in the course of conversation. I may as well state frankly that I do not feel at all authorized to talk for the Central Union Telephone Company. It is not my business, and I do not feel authorized to do so, and anything that I might say might possibly complicate and embarrass the very delicate work which the officers of that company have in hand.

THE PRESIDENT—The Chair would say that it is unfortunate we have no one here who is authorized to speak for the licensees in the Indiana territory, as I can see no possible harm—nothing but good—to result either to ourselves or the public generally from a dissemination of the results of the Indiana legislation. We have some territory in Indiana, and I know in a general way what the results have been, and I will state them briefly if the Convention cares to listen to them.

We have a small patch of territory in the northwest corner of the State and in it only two small exchanges. We promptly discontinued those exchanges, simply because under the law there would not be revenue enough to pay the operating expenses. We went out in good style with the friendly feeling of all subscribers and their regrets following us. We said to the city governments of those two places—Valparaiso and Green Point—that we hoped they would not oblige us to destroy our plant immediately; that we hoped the law might be repealed or that some way might be devised by which we could continue to serve without loss. There were petitions before the council of Valparaiso from other companies asking for ordinances—the Meucci company and some other, I forget what. We said to the Mayor: "Examine for yourself where those companies have done business, and find out whether they have been enjoined or not, and if you think it to your interest, give them ordinances. We have no axe to grind as re-

gards them; simply let our poles stand for the time being." So we went out with flying colors, took out our telephones and discontinued business for five weeks. Mr. Hudson, of the American Bell, came out, and there was a division of opinion in the Central Union as to the best course to pursue. Some of the managers and the American Bell Company were in favor of attempting a compliance with the law by furnishing what I nicknamed a "cheap and nasty" service: by removing the transmitter, by discontinuing night service, by putting a great many subscribers on one line, by reducing the number of operators, and in general by cutting down expenses until the law could be complied with, and still a small margin of profit remain. It seemed to some of us that that was the most unwise course possible, because, in the first place, expenses could not be cut down to a point where any profit would be left, under the law, in the majority of cases, and in the second case such a course would irritate the public.

Prior to the passage of the laws in Indiana the companies had gone before the Committee of the Legislature with sworn reports, stating their income and expenses, and showing that the law could not but be disastrous. An attempt to continue under the law, it seemed to me, would be taken by every subscriber and by every thinking man in the State of Indiana as an admission that those sworn statements were untrue, and that instead of being unable to live at the legal rate, the companies could live and do business and make a profit, and everybody would infer that they had previously been making enormous profits. It would be said, "They are making moderate profits now, under the law, and next winter we will attack them again." The hesitancy in deciding to discontinue business, of course, came from the unwillingness of the owners to sacrifice the plants. This was before the New Orleans decision, and before a number of more recent decisions. We realized that rival companies would come in, ask for ordinances, take possession of the field, and that the City Councils, very likely, might order the removal of our poles and wires. A number of the managers

got together at Indianapolis. Mr. Hudson went to meet them and talked the situation over. Mr. Jackson was invited, but did not go. After talking it all over, the managers decided that the only thing to do was the honest thing, and that was to stick to the statements made before the Legislative Committee, and to abandon the field, unless some plan could be devised under which we could legally operate. I ought to have said that after the law was passed, for a time all the companies took a temporary course. We collected the rental at the old rates, and agreed to refund the excess over the legal rates, in case the Supreme Court of Indiana should decide that the act was constitutional. A test case was made up, and a *pro forma* decision was given in the lower Court and passed right up to the Supreme Court for action, and the decision of the Supreme Court was rendered, I think, in last February or March, some time early in the year, and the decision was against us The Supreme Court said that the acts were constitutional, and that the regulation of telephone rates was clearly within the power of the Legislature. When the decisions were given they were formally appealed to the Supreme Court of the United States, and I have, personally, a considerable feeling of confidence that the decision will there be reversed. I do not think that the United States Courts will allow their patent laws to be tampered with by any of the States.

But as our agreement in regard to rentals had been made contingent upon the decision of the Supreme Court of the State, we now had to decide what to do, whether to fish or cut bait, and it was at this time that the discussion I have referred to took place. We decided that the most honest and the best policy was to adhere in all cases strictly to the facts, to go before the Legislature with an attempt to repeal the existing law, and in the meantime to serve the public at the legal rates where we could do it and make a profit, which was the case in a certain intermediate class of towns, neither very large nor very small, and to discontinue, at those points where we could not make a profit, standing exactly on the justice of the case, without heat, or spite, or

unnecessary hostility, but simply taking a business view of the situation, and saying we will go on where we can make money and stop where we cannot.

In Indianapolis—after the passage of the act—the company first began to shorten sail, and when contracts expired, renewed them for ninety days, I think; these contracts to be extended from time to time for ninety days, or to be cancelled at any time at the option of the company. When the adverse decision came, the Central Union Company cancelled all the contracts, which it was entitled to cancel, amounting, I should think, to some four or five hundred subscribers. They commenced removing those telephones some time in the early part of April, and the row began. The newspapers stirred up the public, and the subscribers met, and there were many new companies formed, to operate under infringing patents, who did all they could to foment the war, and the Common Council moved on the Telephone Company and ordered the poles down, and there was a great deal of bluster all around. The Central Union Company held its peace and minded its business, and took out the telephones belonging to the contracts that were cancelled, and kept on furnishing service until the expiration of the remaining contracts. Meanwhile, some of the subscribers said, "Won't you let us keep our telephones? Under the law you can give telephone service and charge fifteen cents for each toll connection. Let us keep our telephones, and pay a toll charge for each connection." This suggestion was received with favor, and the Central Company began putting in a few telephones on that basis in Indianapolis, putting back a few of the telephones removed, and allowing the payment of a tariff rate. This was entirely satisfactory to the subscribers. But the City Council got hold of that, and they jumped in, and said: "These fellows are putting in telephones in defiance of our orders; we will sit on the whole business." So they did, and they said no more telephones should be put back, no matter whether the subscribers were satisfied or not, or whether the rate was legal or not. Meantime a great fight arose among the competing com-

panies—among the infringing companies—as to which one of them was going to get the ordinance and get the monopoly. There were half a dozen or more companies before the Council applying for an ordinance, each one saying that his telephone was the only one that could fill the bill. Only one of the six would bear testimony to his own telephone, and the other five were all against him. So the City Council said: "We have got evidence of five to one of these six telephones that they cannot fill the bill." Then came along the New Orleans decision. That cleared the atmosphere immensely, and the City Council then concluded that, on the whole, they had better not act hastily. Some time prior to that they had revoked their action in ordering down the poles, and left them in *statu quo*, and after this decision the proceedings of the council were indefinitely suspended. I do not know what the exact situation is, but that is my impression. Then the telephone company started in on a new basis. When the action prohibiting the placing of toll stations was repealed and the action ordering the poles down was repealed, the telephone company went on with the plan of putting back the telephones on the toll basis, and a great many telephones have been so restored. I do not know whether or not all the telephones are now on toll basis.

MR. HOCKETT—I think they are all on toll basis.

THE PRESIDENT—All the telephones were put on a toll basis. Now, the net result up to the present time is that they are not earning enough to pay expenses, or not much more than enough to pay expenses on that basis. There is no money in it as yet. The telephone company have made the most liberal possible arrangements, in order that by making a low rate they may stimulate business to such an extent as to make the experiment profitable; but so far it has not proved to be such. They are waiting and biding their time, and if it proves to be utterly unprofitable, they will be in a much stronger position to go before the Legislature with a request for the repeal of the bill. So much for Indianapolis. I think there was no such fight made against

the Central Union Company at any other point as at Indianapolis. I think there was some trouble at Terre Haute.

MR. HOCKETT—Some fifty instruments were discontinued. There was no trouble.

THE PRESIDENT—I presume that Terre Haute is running on a toll basis now. After the Central Union had tried this experiment in the larger towns, we thought we would try it in the little ones. We tried it in Valparaiso. We had a little exchange of thirty-three subscribers under our old rates, which were forty dollars for residences and fifty for business places. Those people were perfectly satisfied in paying that rate. The service would be going on to-day if there had not been legal interference. The telephones had all been removed, and had been out for six weeks when we made a proposition for the toll system. There was an increased demand for telephones at once, and the exchange jumped up to 55 subscribers, because they were not obliged to pay only when they used the telephone, and they thought the experiment would not cost them much. The result was that these telephones earned about 40 cents apiece per month at a rate for toll messages of five cents. The experiment has practically killed the business in Valparaiso, and after a month or two of further trial, so as to make sure there is no mistake about it, the exchange will be permanently discontinued until the repeal of the rate law.

MR. STORKE—Why was the rate fixed at five cents?

THE PRESIDENT—It was purely experimental. The reason why I fixed it at five cents was because the average use of Valparaiso was about three times a day, which for 300 days in the year would be $45, or about the sum we were getting before. I thought these people would say, "We used to pay $50 a year, and we will use it just as much as we did before." But that has not proved to be the case. It has not worked that way.

The only other portion of the territory remaining to be considered is that of the Cumberland Company, at Evansville. The Cumberland Company attempted to comply with the law by furnishing a cheap and unsatisfactory

service. They knocked off night service and did several other things. But, at any rate, the town rose against them *en masse*, and they became unpopular with their subscribers, and finally the city knocked them out. They cut down poles and wires, and that is the end of it.

That, gentlemen, is a *résumé* of the business in Indiana, as I understand it.

MR. E. J. HALL, JR—I would like to make just one remark in relation to the toll system, and that is, that in my judgment, a guaranteed minimum is an absolute essential.

THE PRESIDENT—I have received a letter from Mr. Wellington Adams, an inventor, who writes as follows:

"In case any of the members of the Association should be desirous of gaining any information in regard to the telephone toll system in operation in this city, they are cordially invited to witness a demonstration at room 14, No. 417 Pine street. It has no connection with the Pan telephone."

Mr. Metzger now took the chair, and Mr. Fay read the following paper on

UNDERGROUND WORK.

Gentlemen.—Last year I had the honor to lay before you some observations on the use of cables in cities, from which I drew two general conclusions. First—That no cable, overhead or underground, had failed to work over a reasonable distance and for a reasonable time, when properly made and connected up. Second—That managers of city exchanges should labor to bring before the public the advantage of mixed systems of overhead and underground cables connecting with aerial lines at distributing points, as being the most flexible and convenient, and the least expensive system in the long run for both the public and the telephone companies. Another year's experience has somewhat modified my confidence in the working of cables, but has, if anything, confirmed my belief in the desirability of a mixed system. I will consider this part of the question first, and come later to the working of cables.

A flood of light has been thrown upon the problem of underground wires by the labors of the Underground Commissions in the cities of New York and Brooklyn. The Commission in the city of New York investigated a great many plans, heard from a great many inventors, took a great deal of testimony, and spent a considerable time without accomplishing much of anything until its presidency was assumed by the Hon. Roswell P. Flower. Mr. Flower is unquestionably an honest man, of great ability and energy, determined to carry out the duties imposed upon the Commission without unnecessary delay, even if this involves "taking the bull by the horns" now and then, and he has done so. The net

result up to date is the beginning of a trench on Sixth avenue, in which it is proposed to lay a multitubular conduit of some kind of asphalt concrete.

The law which created the Commission charged it to enforce the underground law of 1884; it allowed the various electric companies sixty days in which to prepare plans for putting down their wires themselves, to be approved by the Commission; if they failed to do so within sixty days, it charged the Commission with the preparation of a general plan, and authorized them to compel all companies to use this general plan. It further gave the Commission, in order to avoid impairing the efficiency of electric service, discretionary authority to allow the maintenance of aerial lines and cables under proper regulations, "wherever needed for the convenient use of the public, or where the underground conductors can be made thereby more useful."

But the law, while making it the duty of the Commissions to enforce the placing of these wires under ground by means of a general plan or system, provided no funds for the construction of such a system. The Commission, therefore, took the first bull by the horns in assuming that the act conferred by implication the authority to create, or cause to be created, a conduit company to build the conduits for hire, and to force the various electrical companies to use the conduit company's facilities upon a rental to be fixed or approved by the Commission. So such a company was organized, and is proceeding to build the conduit. Of course a magnificent opportunity was afforded for a job, and, as is well known, New York politicians are not behindhand in seizing such opportunities. Messrs. Flynn & O'Brien were active in connection with the work of the Commission, and were undoubtedly interested in the conduit company formed. Their recent exposure and political downfall came just when the company was in the full tide of success, had been accepted by the Commission, had made its contracts, and was about to call on its members for money. (I would say, in passing, that public charges of jobbery and corruption were made against this company and against the choice of material made for the conduit, but Mr. Flower again took the bull by the horns and awarded the contract to the company, and for the material which, all things taken together, he deemed would best carry out the act without unnecessary delay.)

The scandal attending the Flynn-O'Brien exposure has given the company a severe blow, from which it is not certain whether it will recover. Both of these worthies are said to have withdrawn from the company; its President resigned, and no responsible man can be found to take his place; and the subscribers to its capital stock, fearing a repetition of such a disaster as befell the Broadway surface road in the forfeiture of its charter, are said to be very slow in coming forward with their money. However that may be, all telephone men will agree with me, I think, in saying that if all companies must be forced to use a general conduit, some sort of a drawing-in system is inevitable, and that of all materials for such a conduit some sort of concrete is probably the best. Further, that *if* reasonable rentals are charged, although it would be better that the conduit should be, and remain, the property of the city, yet where public funds are lacking, there is no good reason why a private corporation should not supply them. For my part, if I were doing electric business in New York, I should have no earthly objection to any man's investing his money in a conduit system,

the completer the better. I should not care to put any money into it myself, but would welcome the facilities so offered by anybody else.

But I think that every telephone man will agree with me that all companies should *not* be forced into one general conduit. When I said that a flood of light had been let in on this question by the proceedings in New York, I did not refer so much to the education of telephone or electric light men as to that of the newspapers and the public generally. The evident jobbery of the thing attracted universal attention among all the papers; notably the New York *Sun* and *World* were round in their denunciation of those who were attempting, as they expressed it, to levy perpetual blackmail upon the electric companies. It became evident at once to the newspapers what an amount of tearing-up and digging was to be done in the public streets, how many subterranean obstructions in the way of gas and water pipes, steam pipes, sewers, area vaults, etc., lay in the way of the proposed conduit; that a general system of gridironing the city would be of far more serious detriment than the present eye-sore of poles and wires. Not being upon the ground, I cannot say to how great an extent the Commissions were enlightened. I had the honor of being consulted by Mr. Flower twice on the subject, and once or twice by the engineer and chemist of the Commission. I suggested to Mr. Flower to obtain from each electric company a plat of the underground system that would suit its convenience, showing where its masses of wires were located, and indicating the routes which would be shortest and cheapest for itself; to take all of these plats and superpose them in different colored inks on a map of the city of New York, and note the coincidences. I felt quite confident that if this were done, coincidences to any considerable extent would be very rare. The main routes of the telegraph companies and the trunk lines of the telephone companies might coincide in a city like New York, along two or three thoroughfares north or south, but the great bunches of telephone subscribers' wires, the electric light and district telegraph circuits would not coincide with the above, nor with each other, but would form a complication to provide for which, adequately and economically, would be an exceedingly difficult problem. I instanced the experience of the Underground Company in Chicago, which completed over a year ago a system of some twelve miles of from seven to twenty hole conduits, covering pretty thoroughly the business part of the city. In a very few of the streets this conduit is half filled, and indicates overcrowding in the future. In all of the other streets it is nearly empty. There is no law under which the electric companies in Chicago can be compelled to use this conduit, and I doubt exceedingly whether, under the act creating the Commissions, the New York companies can be forced to use the conduit company's facilities there.

However that may be, in Chicago its geographical distribution is such that it cannot be used to advantage, and the companies have gone on of themselves putting down their own wires, each on its own system. Two or three leading streets have been torn up two or three times; but, as a whole, the companies, working each for itself, have selected the shortest route and the smallest possible number of streets; and in putting practically three-fourths of their working wires underground in the business section of the city, have torn up less than two miles of streets; the gridiron arrangement of the conduit company having,

as I said before, torn up over twelve miles, the greater portion of which is useless.

In New York the experiment has not gone far enough to satisfy the public and the Commission of these facts, but a year or two of experience in that city will be sufficient, I think, to show the whole community that the best way of dealing with the undergrouud problem is to let the companies interested put down their own wires, each for itself, using the roofs, alleys and pole lines where, in the lauguage of the New York act, they are needed for the convenient use of the public. In the city of Brooklyn, the intelligence and honesty of whose municipal management seems to be reflected in that of its underground Commission, this is precisely what has been done. The work of the New York Commission has stirred up the underground question all over the country. In some of the cities the Common Councils have very wisely deferred action to await results in New York, a disposition which ought to be encouraged by the exchange men everywhere.

Passing now to the practical working of cables, I addressed the following inquiries to the managers of the principal exchanges using them :

"Some time ago, Mr. Jaques, of the American Bell Company, and Mr. Patterson, of the Western Electric, obtained, experimentally, an arbitrary formula which they thought indicated the limits of transmission of speech by cable. It was as follows : When the static capacity of any conductor in the cable, multiplied by its resistance, multiplied by the square of the length of the conductor in miles, exceeds 12,000, telephonic transmission becomes impossible. In practice a margin of one-half should be allowed for loss in outside connections and instruments, so the product of foregoing factors should not be over 6,000.

"I would very much like to know how this formula is borne out by your experience in underground work, and also the general results of your use of cables ; and, to that end, would request your kind answer to the following questions : Lengths and kinds of cables used, overhead and underground? Average resistance per conductor per mile in each cable? Average static capacity per conductor per mile in each cable? Average insulation per conductor per mile in each cable; trouble with cross-talk in each cable, overhead and underground? Trouble from retardation in each cable, overhead and underground? Trouble with terminals? Other weak points? Cost of cheapest cable? I would call particular attention to the comparison of overhead and underground working results?"

I will here read their replies :

"BROOKLYN, August 19, 1886.

"C. N. FAY, Esq.,

"MY DEAR SIR—Replying to yours of 7th, I have had no means of determining whether the Jaques formula is correct, but as it does not take into account self-induction, I do not think it a very safe formula.

"The greatest length we have had underground is 2,400 feet, and in this length no serious difficulties occur. There is a little cross-talk, but no perceptible retardation.

"We use lead-covered cables, furnished by Brooks, of Philadelphia, and the Western Electric Company—conductors principally No. 20 Standard Gauge, 44 to 45 ohms per mile. Have made no tests for capacity. The average insulation is 50 meghoms per mile; when they go below that we look for defects. Our greatest trouble has been with the terminals; the last ones put on by the Western Electric Company are very satisfactory. One of our cables in the conduit furnished by Brooks, is corroding by the action of water-gas, and, ultimately, the whole lead pipe will be turned into carbonate; possibly another year will complete the work. We have paid forty-two cents for 50, and sixty-seven cents for 100 wire cables; prices are much lower now—about thirty-three and fifty-three. We do not notice any difference in cables overhead and underground in the lengths we now have.

"The poor condition of my health since last February has prevented my doing as much work as I had intended.

"With the underground work we are now completing we shall have cables over two miles in length, and from them I expect to be able to get some information which I hope will be of value.

"Yours truly,

(Signed) "W. D. SARGENT,

"*General Manager.*"

"CINCINNATI, August 10, 1886.

"C. N. FAY, Chicago, Ill.,

"DEAR SIR—Replying to your favor of the 9th, I beg to say our experience with cables is very limited. I expect our trouble to begin very soon. We are preparing to put up about three miles of aerial cables. The longest will be about 1,500 feet. We will use Patterson's No. 20 B. & S. gauge 100 conductors for short lengths, and Day's Kerite with anti-induction insulation for long cables. We have but one cable now in use over 1,000 feet. The cable referred to is, or was until last week, a Patterson aerial 50 conductors, No. 22 B. & S. gauge 1,900 feet long. This cable has been in use on the Newport, Cinn., bridge for nearly three years, carrying trunk lines between Covington and Cinn., exchanges. We have experienced so much trouble from cross-talk that we have not been able to get any new subscribers, and have lost twenty-one of the old subscribers since this cable was put up. I decided this Spring to put up a new cable and take down the Patterson, if a manufacturer could be found who would make and warrant a cable that would work satisfactorily and free from cross-talk. The Standard, of Pittsburgh, undertook the job. Their cable is up and working, but they are not yet through making experiments, and I must decline to report results until they are.

"We have no underground cables in use.

"Yours very truly,

"(Signed) G. N. STONE,

"*General Manager.*"

"BOSTON, August 24, 1886.

"C. N. FAY, ESQ.,

"DEAR SIR—Referring to your letter of 9th inst., I have to say that my facilities for investigation will hardly permit of a detailed reply to your various questions. I will, however, with pleasure give you such general information as I possess upon the subject.

"We have working in Boston twenty-five aerial and nine underground cables. The aerial are in length from 300 to 14,000 feet, the latter figures being obtained by joining more than one continuous length. The size of the conductors varies from 26 to 18 B. & S. gauge, the small size being in old cables and in lengths of not more than 2,000 feet. The greater number of our cables have conductors of Nos. 20 and 22 B. & S. gauge; a few have No. 18. Our longest lengths are Patterson, as is also by far the greater portion of our cable system. Besides that we have a few Phillips' cables, one of which is 1,725 feet in length, of one hundred conductors, No. 22 gauge.

"Our longest underground continuous lengths are 1,500 feet, all Patterson cable, and the greater number of conductors No. 18, B. & S. gauge.

"The measurements for insulation and capacity which you request could not have been made in the time allowed, as such measurements to be of any value must be large in number and made with the greatest care. To insure accuracy terminal heads would also have to be removed, as there would be an uncertain amount of escape at those points. Even with ample time, I fear that we have no instruments suitable for such measurements. Such investigations, however, will be of the greatest interest and value if the necessary care and time can be taken for their prosecution.

"In regard to any comparlson between underground and aerial cables, it is impossible to make such with any degree of certainty without the same conditions, style, size and length, etc., of cables, which similarity of conditions does not exist in our systems. In practice we detect no difference in the working of aerial and underground Patterson cables of approximately the same length.

"The Superintendent of our operating room in Boston, and also our chief operator, concur in the above statement.

"In the case of long lines connected with other exchanges we notice considerable difference in results when comparing lines consisting of open wire for the entire length with those which for any part of the distance enter a cable, the loss of distinctness caused by retardation being very noticeable in lines connected with cable.

"I hope that the investigations now in process will be extended to Patterson cables, made with more than the usual distance between conductors, and that thus valuable data may be obtained.

"I am sorry that my facilities do not enable me to give a more extended answer to your letter.

"I am, very truly yours,

(Signed), "J. N. KELLER,

"*General Manager.*"

"NEW YORK, August 31, 1886.

"C. N. FAY, ESQ., Chicago, Ill.

"DEAR SIR—Your letter of August 7th and telegram of August 30th, received. I regret that a full reply to your letter was delayed on account of sickness, and am yet unable to furnish *all* the information you desire, but I send what I have, hoping that it may be of service to you.

"In reply to your first question, lengths and kinds of cable used, overhead and underground?

"Ans.—Underground, greatest length in one piece, 1 mile Patterson, 50 conductor cable, laid in Brooklyn.

"In connection with our Thirty-ninth street Exchange—1,939 feet, 100 conductor cable, Patterson cable.

"In connection with our Twenty-first street Exchange—1,694 feet, Edison cable, 300 conductor in one conduit, and 200 conductor in another.

"In connection with our Spring street Exchange—2,248 feet, Brooks cable, 400 conductor in one conduit.

"Overhead (aerial) cables.—Greatest length 1 mile, A. G. Day, Kerite cable, 38 conductors, and 2,717 feet Patterson 50 conductor cables.

"2d Question.--Average resistance per conductor per mile in each cable?

"Ans.—Underground Patterson cable in Brooklyn, No. 16 English gauge, 13 ohms per mile.

"Note.—I have not got the figures *at hand* for any of our other cables.

"3d Question.—Average *static capacity* per conductor per mile in each cable?

"Ans.—Patterson underground cable, Brooklyn—20 microfarad per mile.

"Thirty-ninth street underground cable (Patterson)—22 microfarad per mile.

"Twenty-first street underground cable (Edison)—25 microfarad per mile.

"Spring street underground cable (Brooks)—21 microfarad per mile.

"Note.—This is all I can furnish you with at the present time.

"4th Question.—Average insulation per conductor per mile in each cable?

"Ans.—Patterson underground cable in Brooklyn—27 megohms per mile.

"Patterson underground cable in Thirty-ninth street Exchange—300 megohms per mile.

"Edison underground cable in Twenty-first street Exchange—1 megohm per mile.

"Brooks' underground cable in Spring street Exchange—30 megohms per mile.

"Note.—We are still carrying on experiments in connection with above.

"5th Question——Trouble with cross-talk in each cable, overhead and underground?

"Ans.—We have slight cross-talk only with Patterson underground system at Thirty-ninth street, and none with same system in Brooklyn. With the Edison and Brooks' system there is slight cross-talk only, and the same may be said of all our overhead (aerial) cables.

"6th Question.—Trouble from retardation in each cable, overhead and underground?

"Ans.—We are not affected by retardation.

" 7th Question.—Trouble with terminals? Other weak points?

" Ans.—We have no trouble with terminals, with the exception of Patterson cables. We find it difficult to keep the moisture out.

" 8th Question.—Cost of cheapest cable?

" Ans.—Aerial, Patterson. Underground, Brooks.

" Average cost of 100 conductor Patterson cable.....$1 15 per foot.
" " 50 " " " ..... 80 "

" With regard to the comparison between (aerial) overhead and underground cables, I would say that, taking length into consideration, we receive better results from underground than we do from (aerial) overhead cables.

" Respectfully,
(Signed) " W. H. ECKERT,
" *General Superintendent.*"
F.

" C. N. FAY, ESQ.,

" SIR—Below please find memorandum of longest cables of each kind in use in Chicago.

UNDERGROUND.

Cables.	Location.	Length in Feet.	Resist. (ohms per Mile.)	Capacity (M. F. per Mile.)	Ins. Res. Megohms per Mile.	Gauge Cond'r.
Patterson.....	4 Off. (D)...	4,148	40.	.23	1000.	18
Standard.....	3 Off.....	4,110	35.	.23	400.	18
Kerite.....	2 Off. (Z)...	1,600	30.	.54	400.	18
Bitite.....	2 Off. (H)...	1,100	.....	.35	0 5	18

AERIAL.

Patterson.....	8 Off.....	2,754	80.	.17	200.	22
Standard.....	8 Off	5,403	100.	.....	40.	22
Brooks, Jr.....	Tunnel.....	900	200.	.....	0.2	32
Brooks, Oil....	Tunnel.....	900	200.	.....	0.5	26

" Our inspectors report induction and retardation in these cables to bear at a rough guess the following numerical proportion:

UNDERGROUND.

Cables.	Induction.	Retardation.
Patterson.....	45	25
Standard.....	30	25
Kerite.....	20	10
Bitite	20	15

AERIAL.

Cables.	Induction.	Retardation.
Patterson	35	25
Standard	30	30
Brooks, Jr.	None.	50
Brooks, Oil	30	40

"The Kerite and Brooks, Jr. cables are provided with induction shields.

"Respectfully submitted,

"(Signed) B. E. SUNNY,

"*Superintendent.*"

The statistics given by these replies are, as you see, very meagre. In fact, the desire for knowledge has only arisen recently with the necessity for it. Another year will probably add materially to our stock of information. At present it is insufficient to answer my query about the Jaques formula. I have derived some impressions, however, not sufficiently definite to be called conclusions, from our Chicago experience, which I will state, and supplement them from the remarks of the other managers.

MR. FAY (speaking)—Before doing so, however, I may be allowed to say just here that in the New York Exchange they have one mile of Patterson cable 50 wires, 16 gauge, laid underground. They have 1,939 feet of Patterson cable No. 22 gauge, also laid underground. They have 2,248 feet of Brooks' oil cable laid underground; 1,694 feet of Edison cable laid underground, one mile of Kerite cable overhead, and 2,717 feet of Patterson cable overhead. I asked for resistance capacity and insulation. I got no figures from any of the companies except New York and my own, so it is hardly worth while to give them. Boston has 1,500 feet in length of Patterson cable underground. Brooklyn has 2,400 feet of Patterson cable underground and 2,400 feet of Brooks, Jr., underground. Pittsburgh has 14,000 feet of underground cables of two kinds, the Patterson and the Standard. There are two Standard cables, one of ordinary lead cable and one of Starr cable, which consists of seven conductors imbedded in lead. Cincinnati has 1,900 feet of Patterson cable across the bridge. Boston has 1,725 feet of Phillips cable strung overhead across roofs. In regard to the working of these cables, the managers of these various

companies stated for the most part, as I expected, that they got cross-talk. Most of the shorter cables gave comparatively little trouble. The only company which reported considerable lengths in use was the Boston, which by coupling up had some 13,000 or 14,000 feet of cable in length, and the company in Pittsburgh which has cables 14,000 feet long underground, already referred to. The Boston company's cables are mostly overhead. The Boston company stated that they had considerable difficulty in working cables in connection with long overhead lines—as to diminution of talk and clearness of articulation. The Pittsburgh company practically is working one of these—the Patterson, and I think also the Standard cable—but with the Starr cable they have had little success. The retardation is too great to give good results for trunk line purposes.

In the central district of the city of Chicago we have but one underground line of about 1,800 feet in length. It consists of Kerite and Patterson cables drawn into Dorsett conduit, and carries at present only subscribers' wires; but in the north, west and south divisions of the city, where we have exchanges of about six hundred subscribers each, and which are not built up with tall buildings of uniform height, as is the business district, last year we substituted for our pole lines underground cables reaching from a thousand feet to a mile away from the exchange. In the business district before mentioned most of our wires are in cables passing over the roofs of buildings. By connecting therefore from the north district through the business district to the west side we get a continuous length of nearly three miles in cables, of which about a mile was the Waring cable underground, another mile Patterson cable overhead, and another mile Patterson cable underground. Testing these conductors by themselves last January, without connection with aerial wires at either end, we found but little cross-talk in the new underground work, but a great deal in the old aerial cables. This Fall, testing again, we find considerable cross-talk in all of these cables; we find that the insulation runs down rapidly and is very difficult to keep up; that most of this failure is in the terminals; that as the insulation runs down the cross-talk increases; that in comparison with the old overhead systems the cross-talk is probably two or three times as great. As regards insulation, the cable portion of our wires is much more highly insulated than the old aerial wires, especially as we *used* to run them upon porcelain knobs. We find that the paraffine cables absorb moisture at the terminals, and that it is very difficult to keep up the insulation on that account. It is true, however, that insulation of three or four hundred megohms, such as we have had at the beginning on most of our cables might be called "too fancy" for practical use. We are attempting to keep up an insulation on our cable work that we do not follow out throughout the switch-board, office wires, etc.

The general result of our cable work is unsatisfactory, by reason of cross-talk and indistinctness of transmission. We have spent a great deal of time and money measuring up lines, cutting out bad points, and rebuilding and putting everything in shape. One of our best inspectors thinks that the indistinctness of transmission is due very largely to poor contacts in the switch-board caused either by iron plugs which rust, or by phosphor-bronze on other contact points, which tarnish. This theory has been broached but lately, and we are now at work upon it; but *I* fear that the increasing use of cables is destroying the satisfactory character of telephone transmission. We expect this year to put down two miles and a half of Brooks oil cable throughout the central district, connecting our whole system together. When this is completed, a few months' use will show whether my fears are well founded; but I have serious doubts whether we can after this year continue further our underground extensions.

All these observations are fragmentary and crude. Among the odd bits of information we get are these: If a cable conductor forms part of a circuit of heavy resistance it causes more cross-talk than when forming part of a circuit of light resistance. This agrees with the Boston experience, wherein transmission is poorer when cable lines are used in connection with long country wires.

From one of our underground cables, which we have the opportunity of testing, testing wires are run into the Western Electric manufactory. These test wires are not grounded. We find that they become charged every now and then with electricity, always of the same polarity, and will discharge like a condenser on being connected with the earth. What the reason of this charge is we have no way of finding out, as we have no battery wires in the same cable, and know of no reason why an induced charge of the same polarity should always be derived from alternating currents like those of a magneto. Mr. Patterson says that since the earthquake he has not been able to get a flicker out of this cable. He is unable to say whether the earthquake has anything to do with it or not.

An interesting fact is that the Brooklyn cable, a mile long, fifty wires, No. 16 gauge, shows no cross-talk. The insulation of this cable is but twenty-seven megohms, but its resistance is also very low, thirteen ohms to the mile. In Pittsburgh, cables two miles and six-tenths long have been put down as follows: One fifty wire Patterson cable, No. 18 gauge; one fifty-five wire cable. same gauge; one seven wire Star cable, made by the Waring Company, No. 16 gauge. These cables are all of high insulation, 450 to 500 ohms. The static capacity of the fifty wire cables is from .23 to .28 of a microfarad; that of the Star cable is .38; but, although the Star cable is of much lower resistance, it cannot be used with satisfaction, the Pittsburgh Exchange depending upon the other two cables.

The very curious fact is notable that the Brooks', Jr., cable, with only one-fifth megohm of insulation resistance, seems entirely free from cross-talk. This is probably due to the spiral induction shield in each wire, which carries to earth all escape.

Respectfully submitted,

C. N. FAY.

After he had finished reading the paper, Mr. Fay spoke as follows:

MR. FAY—These are all the facts that I have been able to glean, gentlemen. In Chicago the general results are unsatisfactory. We have more cross-talk and less distinctness every year, and I am sure that it does not come from the condition of our instruments, or from the condition of our outside lines, which are practically new. They have been almost entirely rebuilt within the last two years. The fault must lie either in the cables, or in the switch contacts of which I speak.

MR. FROST—I would like to ask the President if he communicated these facts to Mr. Flower in his interview with him.

MR. FAY—No, sir. I stated to Mr. Flower in a general way that our transmission was running down all the time, and was becoming more indistinct, and when he left me, he seemed satisfied that it was useless to try to force telephone cables into the same conduits with others. His general impression was that electric light wires ought to be put by themselves and telegraph wires by themselves, or possibly telegraph and telephone wires together. "But," he said to me, "I haven't any option in the matter. I have got a law to carry out, and I will carry it out."

MR. FROST—I thought the facts, which the President has stated, should be communicated to the public, for the reason that they ought not to base their conclusions on the paper which the President read last year. The public have invested largely in cables, and the conclusions stated at the last meeting have hardly proved themselves during this year, and it is well that the public, before they put their money into large enterprises, should be made familiar with that fact. Mr. Flower, I think, should take notice that cables are not doing what it was expected they would do. Our experience is precisely that of the President.

THE CHAIRMAN—You have heard the very able paper read by Mr. Fay on the subject of underground work; what action will you take?

MR. EASTABROOK—I move that the paper be accepted and spread on the minutes.

The motion was carried.

MR. HOTCHKISS—I should like to inquire from Mr. Fay as to any knowledge on his part as to the distance that the telephone has satisfactorily operated through a submarine cable, and what size of insulating material surrounded the conductors of that cable ?

MR. FAY—I have no specific information. I know, in a general way, that some time last year they laid a submarine cable from Brighton, or some place in the Isle of Wight, out to a lightship in the Channel, and that they used that for communication, for signaling the arrival and departure of vessels and for weather observations, or something of the kind, and the general impression I have is that that cable was three or four or five miles long.

M. Berthon, of Paris, who was over here two years ago, told me that, by using a metallic circuit, he had obtained successful results through cables of india-rubber, with a very heavy insulation, for a distance of six or seven miles. Mr. Preece, of the English postal telegraph, told me that by using a metallic circuit he had been able to talk through a cable, by telephone, over twelve miles, but it was very unsatisfactory, and at that time none of those gentlemen were willing to say that their metallic circuits would work satisfactorily for more than four or five miles.

MR. SEELEY—I would like to state that the underground Commissioners of New York City have had before them all the scientific experts in the United States, and some from Europe. Mr. Frost seems to think that these problems have not been put before them. The underground system has been thoroughly demonstrated to them, pro and con.

I would like to say that in the North River we have nine miles of submarine cables, single lengths. We have connected them all together, making them one continuous length of nine miles. We have also attached to those cables twenty-five or thirty miles of iron wire—aerial wire—and obtained good results. The cable conductors are three No. 18 wires, English gauge, stranded together; seven conductors in each

cable. There is very little cross-talk. The cable has an iron armor. It runs from New York to Jersey City.

THE CHAIRMAN—You do not use this for every-day practical use?

MR. SEELEY—No; the connecting up, so as to make nine miles of continuous cable, was simply for an experiment.

MR. GIFFORD—Do you think you would get as good results if you should have a 50 or 100-wire cable, instead of one conductor, and have all the conductors in use?

MR. SEELEY—We are bound to have more or less cross-talk, in any case, so far as that is concerned. It is impossible to do away with cross-talk.

MR. GIFFORD—A single conductor will work very nicely, whereas if you have several hooked up, your cross-talk will kill the whole thing.

MR. FAY—We have always had very good luck in making experimental tests; everything was satisfactory. But in practical operation we do not always get so satisfactory results; and when I say satisfactory, I mean satisfactory commercial results, such as our ordinary exchange subscribers require—good, clear, unmistakable talk, free from hissing and labial sounds, which we have to contend with in every day work. Our people frequently say, "We cannot hear—we cannot understand;" and those two words sum the whole situation.

MR. GIFFORD—What size conductors do you use?

MR. FAY—From No. 4 to No. 26—all sizes.

MR. BENNETT—I would like to ask some of the scientific gentlemen or some of the practical gentlemen, and I would rather hear it from the practical men, because Mr. Fay has told us that the scientific test was right—that he could always get that right—but the customers, the men from whom we are to get our money to pay for running the business, say, "we cannot hear." Now there seems to be quite a little craze on "underground." We are told here by our President that it is not practical. Now if it is not practical, we should not adopt it. We should not

adopt anything that is not practical for the business. I have talked with some gentlemen who have been a long time in the business, and I am told by them that the overhead work gives a great deal better satisfaction, that it suits their customers, and there is not any need for us to fear being driven underground. I do not think there is a gentleman here that wants to go underground [Laughter]. I do not think there is a gentleman here that wants to put his *cable* underground, and I am quite sure that the company I represent does not want to; financially it has been underground a good while. If the figures that the President gave us yesterday in his speech are correct, the telephone business of the country needs the fostering care of the best financial ability that can be given to it, and there is nothing that will make the stockholders of our companies feel better than good dividends, and we should be slow about trying experiments. I am glad that Mr. Fay has tried them and that Mr. Metzger has tried them. Why, there isn't anything that will bother the Law system or the old-fashioned plug-board or the Chicago new multiple switch, more than to have people calling "Hello! hello! I can't hear."

MR. DURANT—I very much regret that I have not to-day a paper on the electrophore system, devised by Colonel Flad, President of the Board of Public Improvements. I sent a copy of it to Captain Stone for examination some time ago, and it was taken from his table and has not been recovered. I mention it in connection with this discussion on underground cables. It is a system for overhead wires, and if the Convention is in session to-morrow I shall endeavor to obtain another copy of it and read it. I do not know whether our Secretary has a copy of it or not.

THE SECRETARY—I did not make a complete copy of it at the time you loaned it to me.

MR. DURANT—I am sure it will interest you gentlemen who are afraid of underground work and seek some other means of conciliating the municipal authorities in the matter of wires. Drawings accompany the paper. The paper was

not fully prepared at the time I sent it to Captain Stone, and it still lacks some figures, which I think can be supplied.

THE CHAIRMAN—I think, Mr. Durant, the Association would be very glad to have you read a copy of the paper. It will be a matter of interest and utility to the Association.

We would now like to hear the paper of Mr. Sargent, of Brooklyn.

MR. KELLER—I am under the impression that Mr. Storke's paper has not been accepted. I therefore move you that Mr. Storke's report be accepted with thanks, and placed on file.

THE CHAIRMAN—We will consider that the report was received and ordered to be filed, and, therefore, Mr. Storke can consider himself thanked.

At the request of the writer, who was not in good voice, the Secretary then read the following paper by Mr. W. D. Sargent, of Brooklyn, N. Y.

UNDERGROUND WORK IN BROOKLYN.

The very rapid growth and accumulation of wires near our principal office in Brooklyn compelled the consideration of the underground question, regardless of the newspaper hue and cry and compulsory legislation. Unfortunately for the credit of our good intentions, no work was done until after the passage of the present underground act, in May, 1884.

It may be noted, in passing, that the sentiment against poles and overhead wires seems to have been manufactured by newspapers and underground companies with an "axe to grind," evidence of which is our present extensive system of poles and wires erected without protest from property owners and citizens.

In the summer of 1884, it was decided to attempt to place some wires under the streets. Believing that such a complex system as ours could never be fully accommodated by wires laid permanently in the ground, we decided to lay a conduit comprising a series of ducts, permitting the introduction and withdrawal of wires and cables, thus providing space for future growth, for the withdrawal of defective cables and the substitution of others, as experience determines are the most suitable.

Up to this time, no cables or wires can be had whose durability has been sufficiently tested to warrant the faith to lay them permanently underground, without an expectation of being able to reach them without tearing up the entire street. While the liability to damage when laid permanently underground, may be very remote, facilities for handling cables without opening the street are worth providing for on economical grounds. In many of the systems already laid, it is customary to box the cables in wood and fill in with asphaltum or

cement. The same box can just as well be left empty and the cables drawn in and out without much greater expense, provided the wood can be made durable.

In looking up the durability of wood laid underground, in which we were very much aided by the Commissioners of Electrical Subways, we found the most competent authorities agreed that the process of creosoting, when properly done, would preserve it indefinitely. Conduits of different materials—iron, cement, asphaltum, etc., were examined, but creosoted wood appeared to be the cheapest and as durable as any. These considerations led to its final adoption for our conduit.

The form decided upon was a square box—sides, top and bottom one and one-half inch plank, subdivided into ducts, varying in number from ten to four, according to requirements, the divisions being made with one-inch boards.

As the manholes in the first work were not very frequent, we anticipated that friction and the consequent strain of drawing in long and heavy cables might be sufficient to injure them. With the intention of obviating this difficulty, the ducts were made three inches high by two wide, and rollers were placed permanently in the bottom of each duct for the purpose of lessening friction. This we found to answer very satisfactorily.

In the season of 1885, the Underground Commissioners assumed direction, and, at their suggestion, the rollers were made into small carriages, consisting of two rollers below, one above, the cable resting on the upper roller; the intention being to withdraw the carriages after the cable was pulled in and using them for successive cables.

In the more extensive work which we have done in 1886, the manholes becoming more frequent, we find that lengths of 1,000 feet, or less, may be readily drawn in without injury to the cable, and without rollers or any anti-friction device.

[The blue-print drawing, which is here for the inspection of members interested, shows all the details without further description.]

The general plan of distribution contemplated for the thirteen miles of conduit which will be completed this year, is to bring the cables out to poles, or on the house-tops, in bunches of twenty-five, fifty and one hundred, and distributing, as now, through the air. This method of distribution has been permitted by our Underground Commissioners, pending the development of something better. We are not prepared to offer any plan for introducing individual wires into the buildings.

Preliminary to opening the streets, a map was made showing the location of water, gas and sewer pipes, from information obtained from city departments and gas companies. This information proved to be as valuable as that of the pilot who knew every rock in the channel, and when the ship struck, said, "There is one of them now," and it was in this way that we came to know every pipe in the street, that is, as we struck them.

We think it is safe to say the obstructions in the streets of Brooklyn are less than in many other cities, even of smaller size. The character of the ground is sandy and usually easy digging, but frequently obstructed by large boulders, which require blasting to remove them. There is no ledge of rock in Brooklyn.

The proper way in laying out a line for an underground conduit is to dig test holes over the route desired, thus locating all obstructions, and digging trench accordingly. The depth of trench with us is usually 30 inches; but owing to service pipes for gas and water and occasional large mains, we have gone in some cases to a depth of seven feet.

As to the durability of our work, time alone will tell. The first half mile of our creosoted conduit will be down two years in November, and inspection just made before the writing of this paper shows no sign of decay in the timber, and the iron nails and screws are not corroded.

The objection usually made to this conduit is that it is not water-tight This is true, nor did we attempt to make it so. The only damage that can result from water flowing through the ducts is the accumulation of mud or silt sufficient to clog them up. In the work already done, after two years' service, a recent examination at several points showed no deposit of any kind, and we are able to move the cables freely. In order to prevent the possibility of this trouble in the more extensive work now in progress, we have adopted the pian of pouring hot pitch or asphaltum over all the joints, sealing them up effectually.

Regarding the location of manholes, these have heretofore been placed only at points of distribution and where obstructions rendered them necessary. The growth of the underground system will doubtless require manholes at the junction of all streets.

The creosoted wood (North Carolina pine) is treated and furnished by an establishment in our city, the price under our present contract being $41 per 1,000 feet, board measure, including mill work. The conduit is made up complete by our own workmen into sections of 16 feet, which are then carted to the trench, dropped in, joined up and covers screwed on.

Special care is taken where sections join to make the ducts continuous and in line. In addition to pitching the joints, the junction of sections is covered with felt and heavily pitched. The cost per foot of single duct laid in the trench and ready to fill in, based on the work already done, is from six to ten cents per foot. The cost in detail is shown by statement, open to the inspection of members.

Our first trench work was done by contract, the price being thirty cents per foot, 18 inches wide by 30 inches deep, with extras for rock work and additional depth.

Work done by contract has its disadvantages, principally on account of inability to control the work as thoroughly as is desirable. For this reason, we decided to do the work ourselves this year, and it is probable the cost will be less. The advantage, however, is in the absolute control and thoroughness of the work. The ordinary Italian laborers are employed under suitable foremen.

We have made a contract with D. H. Dorsett for five miles of his asphaltum or concrete conduit, which is now well under way, but regarding which, no figures can be given at present.

In cables, we have used principally the lead-covered pipe, furnished by the Western Electric, Brooks and Faraday. These are made up in fifties and hundreds, with wires twisted, in pairs. The twisting in pairs is done to provide for perfect metallic circuits when they become necessary. During the time we are

using grounded circuits, the interference between the wires of a pair is greater than if not twisted, if they happen to be used simultaneously. The possibility of this is very remote, and I don't think worth providing for.

One section of 4,500 feet just laid by Brooks is interspersed with braided tinsel for the prevention of interference. No comparative tests have yet been made to determine its value. The balance of the cables are without any special device.

The first cables drawn in in 1884 began to show trouble in about eight months, and the manufacturers were notified, their investigation finding the trouble in the terminals, except in one Brooks' cable, in which the lead pipe was found badly corroded. One section of 600 feet was withdrawn, in which we found a crack in the pipe at a wipe joint that had admitted moisture. New terminals were put on. The whole difficulty with the terminals is to get them moisture-tight. Within the last few months air and moisture-tight terminals have been furnished, which, we believe, will prevent future trouble.

The durability of lead pipe is a very important question. The corrosion of the Brooks' lead pipe has now reached one-eighth of an inch in depth, and the indications are that the whole pipe will be consumed. Opinions differ as to the cause of this corrosion. The product is undoubtedly carbonate of lead, and Prof. Plympton says it is caused by the action of water-gas, which collects in the ducts. Other authorities believe it is due to the vapor of acids in the creosoted woods. The pipe was made by Tatham Bros., of Philadelphia, and is said to be pure lead.

The Western electric cables have a small percentage of tin, which was put in to stiffen the pipe; but it seems to serve another useful purpose, inasmuch as their cables laid alongside the Brooks, show no sign of corrosion. It is fortunate that a remedy is so immediately indicated for what promised to be a serious evil.

Our greatest length of cable under ground up to the present time has been 2,400 feet; interference is very slight and retardation not perceptible. The trunk wires between New York and Brooklyn work through two miles of cable without serious difficulty, and we don't anticipate our trouble will begin until we get beyond that point. The longest cables laid this year are 4,500 feet, and tests show that we shall have no difficulty in working them. The insulation varies from 50 megohms to 500 per mile. Static capacity not measured.

We expect to be able to maintain our pole wires for a reasonable time to insure durability of cables and to retain them entirely where the wires are less than 50. New poles will necessarily have to be put up to aid in distributing from the underground, and we are now putting up some for that purpose.

One of our Underground Commissioners is now in Europe, and in a letter from him, dated Milan, he writes as follows: "I have heard of no underground telephone wires since I left London; and I am a little in doubt abont a few in Berlin, but the rule is—'mount them on the house-tops.' The government can compel submission of the citizen, but awards him some compensation. Perhaps the most striking incident of the journey was finding a new line of telegraph poles in the streets of Antwerp. I have ordered a photograph of them. Preece says he never knew a case of failure of well creosoted timber through decay."

This was written after the writer had been at Liverpool, London, Brussels, Antwerp, Cologne, Weisbaden, Heidelberg, Frankfort, Berlin, Munich, Lucerne, Milan. This seems to indicate that the problem for underground wires for a telephone system is quite as difficult a question there as it is here.

W. D. SARGENT.

MR. FAY—I move that Mr. Sargent's paper be printed, and the thanks of the Association tendered.

The motion was carried.

MR. FAY—I would like to make one brief remark in reference to Mr. Bennett's observation a little while ago. I understood him as receiving the impression that I was distinctly committed against underground work. That is not true. I have been an underground man from the very beginning, particularly in regard to the work to be done in large cities, because I thought that eventually it was the most economical way of operating. At the last convention I said so very unequivocally, and also said that, so far as I knew, no cables had failed to work when properly put up and constructed. All I desire to emphasize this year is that I am not so sure about the satisfactory working of those cables. We have certainly had a great increase of our difficulties from indistinctness and cross-talk, and in regard to cross-talk, an observation in Mr. Sargent's paper suggests this point, that you can never tell when you are going to get cross-talk in a cable or when not. I have repeatedly had that experience and called up the exchange to trace the matter and see where the cross-talk was. Before I got the exhange the other fellow would have stopped talking and his wire would be switched off. The juxtaposition of wires in a cable plays a very important part in the cross-talk that results. My experience in all previous observations has been that a sufficient number of conductors in a cable would operate as an induction shield to protect others. I have found cables of 100 wires free from cross-talk.

MR. KELLER—How do you have your wires laid up?

MR. FAY—They are laid up without any attempt at cross-connection or displacement of any kind. They are made in lengths and spliced by the factory, as they come, without any reference to metallic circuits.

MR. GIFFORD—I would like to inquire of Mr. Sargent the size of the conductor of the 4,500-feet length that he put down, which works satisfactorily?

MR. SARGENT—All our cables are No. 20, standard gauge, that is about 20 lbs. of copper to the mile, and with a resistance of from forty to forty-five ohms. We did think of using No. 18, but we have no cable wires of a larger size than the No. 20 standard gauge.

MR. GIFFORD—I want to call the attention of the Association to one little experience of our Company. Some four years ago we put down a Patterson cable, put it in an iron tube under the canal, over the Ohio river at Louisville, and about two years ago we had a flood and it tore the whole business up. It tore the cable pole down, and we had to put in a new cable. But when we drew out that old cable I found in one place about two feet, and in two or three other places shorter portions, where a portion of the cable seemed to be oxydized. You could crumble it up like white lead. That was a cable made some years ago. I have not discovered any trouble since. I would like to know whether any other gentleman here has had a similar experience. The lead pipe was oxydized. Mr. Sargent referred, in his paper, to the oxydation of some cables. That is an important question. I am getting ready to put down a good many cables, and that is a very important thing for me to know about. If we are going to have an oxydation of this lead pipe business we want to know it now.

MR. SEELEY—Our cables have been put down during the last two years. I think, prior to that, Mr. Patterson failed to put any tin in the lead pipe. Probably, Mr. Gifford's pipe is pure lead. We are having no trouble with our underground cables. They all work nicely. I would like to ask Mr. Fay to what extent his insulation depreciates in the Patterson cables?

MR. FAY—The insulation has depreciated principally in the terminals. The insulation we had at starting, in most of the cables, would average 300 megohms to the mile. Some cables ran down very far, and on examining we found

special mechanical defects. They have a habit in Chicago of driving a piece of gas-pipe, with a pointed piece of iron in the end, under the roadbed, then they thread their electric light wire through under the surface of the street. One of those pipes had been driven clear through one of our cables, box, conduit, and everything else. It happened to tear off the lead covering and pass to one side of the main body of the wire, so that not a single conductor was torn; but they were twisted up, and moisture got in there and ran the insulation down to almost nothing. But we find it pretty hard to keep the insulation from running down to thirty or forty megohms, and when it gets lower than that the cross-talk becomes very great. There is a wire running into my office that has bothered us for two or three years. We are at it just at this present moment. The general cause of dissatisfaction is, not that we cannot make the cables work, but that we find an increasing disturbance from cross-talk all the time.

MR. LOCKWOOD—What is the largest conductor you have?

MR. FAY—The largest wire we are putting down is No. 16. We are putting down larger conductors every year. We began with No. 26.

THE CHAIRMAN—I notice among the members present, Mr. Patterson, of Chicago, a gentleman who I know has had more practical experience with cables than any one else here. Perhaps he may say something regarding the electrical conditions of cables. We would like to hear from Mr. Patterson.

MR. PATTERSON—I do not know that I have anything in particular that I would like to say, but I keep looking around and thinking of these things. Within the past year my faith in the formula for determining the distance through which cables can be worked has been pretty thoroughly shaken. That formula was derived from telegraph work on ocean cables, and, by inference, applied to telephone work on underground and aerial cables and composition lines. But the inference, I think, is not borne out by the facts.

The work is not governed by the same law, because a telephone current is attacked in two ways, one by diminishing the loudness of the sound, and one by disturbing its distinctness. Now, with a battery current, resistance alone is no serious obstacle. You can put on more battery to overcome the additional resistance, but in telephone work you have a certain amount of power in the first place, and you cannot increase that. And when you get to a resistance at which you cannot work satisfactorily, I do not think you are going to improve the working by loading the capacity of the line. The formula assumes that capacity and resistance are interchangeable. But I think that, while the resistance and capacity undoubtedly do work together and have a combined effect, there is also an independent limit both of resistance and of capacity, which it will not do to exceed. Another thing, I think, that while two lines of continuous cable may work, as compared, one with the other, according to some definite law, yet when we take a cable and put on a long aerial line, the law (if there is any that governs the working) is much more complex; that is, if you take a long cable line and a long aerial line and put them together, it is found that you can talk in one direction much better than in another. Another thing, which is more speculation than anything else, I think, is, that the nature of the metal or sheath surrounding the wire may have some effect. For instance, we may take two miles and measure them with the bridge and find they are equal; and then measure the capacity and find they are equal. One may be surrounded by a metallic sheath or envelope, and the other may be surrounded by a group of conductors; and yet, in the practical working, there will be a marked difference between the two. Now, what causes this, and how to determine it, and whether or not it is due to any general law, I am unprepared to say.

MR. LOCKWOOD—I may, perhaps, be pardoned for reiterating a certain opinion which I expressed in a paper two years ago, which was to the effect, that increasing the conductivity of the conductor by increasing the size of the conductor, is certainly the easiest and most palpable and the easiest

way of helping the worst trouble, namely, that of the sluggishness with which speech is conveyed. Mr. Fay, as he says, is continually increasing the size of the conductors of his cable, and there can be no doubt that whatever other factors enter into the problem, that that is always a move in the right direction; for this reason, that the sluggishness I have spoken of depends not upon the mass of metal in the conductor, but upon the extent of surface of the conductor among other things; also upon the thickness of the insulation and the length of the conductor. Now, by increasing the size of the conductor, you do not increase the surface in the same ratio, because the surface depends upon the circumference of the wire. If you double the size of any given wire, you quadruple the sectional area, while you only approximately double the circumference. I merely speak now as reiterating the opinion expressed a couple of years ago.

MR. HOTCHKISS—I can add only one more suggestion to Mr. Lockwood's able remarks in connection with the use of cables, and that is, to increase the body of the insulating material around that increased size of conductor. I think, by so doing, you will do what you gentlemen have been doing in other ways for the last three or four years. It is like using six or eight-inch upright and cross-arms in place of two and a half and one inch. If your business will not permit you to pay for such a conductor, such a body of insulation, why, of course, you must get along the best way you can.

MR. DURANT—I desire to say that I have an incomplete copy of the paper I referred to this morning; and while it is not my production, for the purpose of presenting it to this Convention, I will father it. It is incomplete, and will require revision before printing. If the members would like to hear it and see the accompanying diagrams, I am at their command.

THE CHAIRMAN—I would suggest to the Convention that in order to avail ourselves of the kind invitation of Mr. Durant to participate in the excursion this afternoon, it is

desirable that we adjourn very soon. I think the reading of papers had better be postponed until to-morrow.

MR. DURANT—I hope, of course, the Convention will continue over to-morrow. I should prefer to read the paper to-morrow rather than to-day.

THE CHAIRMAN—The Secretary has some letters which he desires to read before adjourning.

THE SECRETARY—Two letters have been received, which seem proper for the Association to hear. One of them is from M. Berthon, an honorary member of the Association, who is the General Superintendent of the Telephone Company operating in Paris, France. He writes from that city, as follows:

SOCIÉTÉ GÉNÉRALE DES TÉLÉPHONES
(Réseaux téléphoniques & Constructions électriques)
Société Anomyme an Capital de 25,000,000 de Francs.
41 Rue Caumartin,
PARIS, le 27th August, 1886.

To the Secretary of the National Telephone Exchange Association,
Southern Hotel, St. Louis, Mo.

MY DEAR SIR—In reply to your favor of the 19th July, I send you by this mail the following information and documents, viz:

1st. The Paris Telephone Directory.
2d. Tabulated Exchange Statistics.
3d. Maps of the Paris Exchange.
4th. Number of Subscribers in Paris, 4,317.
5th. Number of Branch Offices in Paris, 12.
6th. Miles of overhead wires, metallic circuits, 40.
7th. Miles of underground wires in cables, metallic circuits, including 900 miles for trunk lines, 4,500.
8th. Number of trunk lines connecting the 12 branch offices, 288.

In the hope that the documents may reach you in due time,

I remain, sir,
Yours very truly,
SOCIÉTÉ GÉNÉRALE DES TÉLÉPHONES,
Le Directeur,
A. BERTHON.

I would say that I received the telephone directory of which he speaks, the day before leaving New York, but the tabulated statistics, map of the exchange and other matters mentioned have not yet arrived. They may not reach me

before the close of this meeting, but the information they contain can be printed with the proceedings, if so desired.

MR. EASTABROOK—I move that they be printed with the proceedings of this meeting of the Association.

The motion was carried.

THE SECRETARY—The other letter is from Dr. Plush. In view of the fact that last year we were favored with a paper on the Western Electric multiple board, and were disappointed in not having a promised paper by Dr. Plush upon the Law multiple board, and considering that the Association was to meet this year in a city where the Law multiple board is in operation, I endeavored to secure a paper from Dr. Plush for the meeting. I am sorry to say, however, that instead of a paper he has sent a letter, which I will read:

THE BELL TELEPHONE COMPANY OF PHILADELPHIA,
GENERAL OFFICES,
PHILADELPHIA, August 11, 1886.

GEN. C. H. BARNEY, *Secretary.*

MY DEAR SIR—One year ago I promised a paper on the Law Multiple Switch system in use by this Company, to be read before your Association at its annual meeting, but owing to pressing duties which occupied my whole time, I was unable to do so.

Fear of again placing myself in the same unpleasant position has prevented me from answering your invitation to furnish the paper for this year's session.

Aside from the facts above stated, a delicacy must necessarily be felt by any one attempting to write such an article, lest some comparison may be so made as to reflect upon other systems in use—for it does not follow that a system, because it fills every requirement here, would do so in all other places. The character of business, the disposition of the people, their wants, education, tastes and prejudices, will have a bearing upon it. The size and population of a city, the number of sub-exchanges and amount of business they may do, must give a form and character to the system employed.

I believe it pernicious to the general telephone interests to model after other exchanges and shape forcibly the machinery and methods by the opinions of those whose conditions and necessities are entirely different.

The Law Multiple has been a very successful introduction with us, filling in most respects every demand. We believe the principles embodied in it to be the correct ones—as they are simple and aggregate, less joints and connections per wire than any other board with which we are familiar.

We have put it to a severe and prolonged test in this city—since August, 1884—and at the present time have about 1,500 subscribers, and work in conjunction with it an annunciator board, which accommodates all club lines and trunks.

The economy of any system must lie in the facility with which connections and disconnections can be made without waste of labor, the latter of which, we believe, is reduced to a minimum in this board.

The plan and general features of the Law Multiple system have been so frequently published that they must be familiar to all telephone managers, so that the field has been pretty well covered, and but little can be said with propriety, for interest and local pride have become identified with the system fostered by the various companies, and any comparison, however kindly made, might not be received with the same spirit.

I have thus at length explained my views, more for the purpose of placing my position properly before you, and clearing myself of the charge of discourtesy, which I admit would have been justifiable otherwise. Believe me,

Very truly yours,

SAMUEL M. PLUSH,

General Manager,

The Bell Telephone Company of Philadelphia.

MR. SEELEY—I move that the letter be accepted and spread on the minutes of the Association.

THE CHAIRMAN—If there is no objection, the letter will be received and printed in the minutes.

Before we adjourn for the day, the Secretary desires me to announce that the papers for to-morrow morning will be one on "Long Distance Telephony," by A. S. Hibbard, and one on "The Electrophore System," which will be presented by Mr. George F. Durant.

It still lacking a few minutes of the hour of adjournment, Mr. T. D. Lockwood read from the London *Punch* a humorous article upon the troubles of an Englishman at the telephone, after which the Association adjourned, until Thursday morning, at ten o'clock.

THIRD DAY'S PROCEEDINGS.

THURSDAY, September 9, 1886.

The Association was called to order at 10 A. M., Vice-President Metzger in the Chair.

The Secretary read a telegram from Mr. W. H. Eckert, of New York, stating that having but recently returned to business from an absence caused by serious illness, he was unable to attend this meeting of the Association, and conveying his best wishes for its success.

THE CHAIRMAN—The first paper to be read this morning is by Mr. A. S. Hibbard, of the Wisconsin Telephone Company. The subject is "Long Distance Telephoning." If it is the pleasure of the Association, the Secretary will now read the paper, in the absence of Mr. Hibbard.

The Secretary then read Mr. Hibbard's paper, as follows:

LONG DISTANCE TELEPHONING, AND THE PRESENT OPERATION OF TOLL TELEPHONE LINES.

A review of the work of the past year in the department of Toll Lines operated by the companies forming this Association seems to present but little that is new or interesting. No great amount of new work has been done. A number of the companies have made, to them, important extensions, and an improvement in the character of the work is apparent everywhere. The cheap lines, built three and four years ago, are proving burdensome in the cost of repairs, and, in many places, are being replaced by new and better lines. The problem of long distance telephony, however, is no nearer a solution than it was a year ago, and it may be doubted whether the gradual occupation of territory by local companies will be found the means of solving it. The most apparent reasons for this are, first—the systems to-day consist of single wire lines, and second—the limit of distance, in the successful working of such lines, is variable and dependent upon conditions not governed either by the parties owning or those attempting to use them. In our Exchange service we guarantee to each subscriber the means of quick, certain and successful communication with any other.

In our Toll Line service we would like to guarantee to patrons at each town an equally perfect means of communication with any other town. At present we are obliged to qualify our offers, and can give the perfect service only, if the line is not busy, or not noisy, or is free from "cross-talk," or the instruments at both ends are in perfect condition, and the station wanted is not too far away. These limitations are most confusing to the would-be patron, and must produce in his mind a series of just so many doubts concerning the efficiency of the service, a condition of things certainly detrimental to its popularity. In some localities better results are obtained than at others, but much is yet to be done to make Toll Line service perfect and popular with the public. In this condition of the service, a seeming paradox is found in the fact that the earnings of the established Toll Lines are increasing, the results for the past over the previous year showing a marked increase. This I attribute largely to the fact that the public is becoming educated in the use of the telephone, and obtains much more satisfaction in the use of long lines than ever before. The difficulties in perfecting long line service have remained in *statu quo*, and patrons have evidently determined to use the lines and encounter the troubles incident to them, the best possible proof of the great conveniences of such service. Among the improvements asked for are:—enough wires to accommodate everybody at the most busy time, no induction, no noisy wires, no weak effects and (*always*) cheaper rates. Any one of the above items furnishes, at least, food for reflection. In the present system of single wire lines, a second wire to any given point necessitates a new line complete on a separate route. In most cases the limited number of available highway routes would prevent the extension of more than three or four wires, and, at the "busy time" mentioned these might prove insufficient. The "noisy wire" and induction troubles have certainly not been surmounted, and we still must put up with weak and unsatisfactory effects. In rates we find it impossible to compete with piratical telegraph companies. It seems, therefore, that at every issue we fail to meet the above noted public demands, and yet the public use of Toll Lines increases. This is certainly conclusive evidence of the great service of such lines to the public and the great future of successful long distance telephony. The various companies are apparently striving hard with the difficulties presented, and are experimenting and improving as rapidly as possible, the net returns on their investments in Toll Lines evidently warranting their best efforts. The following is a summary of some of the more important details of Toll Lines service as reported by twenty-two representative companies, and is a fair showing of the condition of the Toll Line systems now in operation. In its present imperfect form this information will be of but limited value, even for purposes of comparison. I present the report, however, in the hope that it may be of service, at least to future statisticians.

Name of Telephone Company.	Mileage of Poles.	Mileage of Wire.	Number of Exchanges connected.	Number of Subscribers at these Exchanges.	No. of Toll Offices connected, where no Exchanges exist.	Average Number of Messages Monthly.	Average Rate per Message.	Average Monthly gross Receipts per mile of Wire.	Longest Line worked successfully (in miles).
Central Union	7,655	10,460	122	15,500	614	68,900	22c.	$1 45	75
Michigan Bell	2,238	3,421	68	7,295	203	40,000	20	2 39	145
New England	2,053	3,036	88	13,247	272	26,409	20	2 37	100
Wisconsin	1,942	2,538	65	4,288	163	11,953	28	1 98	199
New York and Pennsylvania	1,600	2,200	22	2,236	281	20,000	20	1 82	60
Central New York	1,561	1,903	16	1,412	325	22,858	15	1 80	60
Cumberland	1,157	1,392	17	2,821	134	8,800	25	1 60	65
Empire State	733	1,164	11	990	95	6,622	22	1 29	80
Great Southern	603	936	6	1,311	94	5.547	32	1 89	142
Buffalo Bell	614	812	11	3,343	10	9,850	19	2 29	75
Delaware and Atlantic	675	783	50	2,073	28	7,500	20	1 69	65
Pennsylvania	488	605	33	2,360	....	2,365	15	59	74
Chicago	482	1,189	10	4,676	63	7,600	25	1 96	100
Nebraska	451	491	26	2,308	22	6,498	27	3 54	111
C. D. & P. Co., Pittsburgh	412	830	30	3,338	37	4,780	25	1 43	135
Ohio Valley	370	510	3	1,585	32	3,642	22	1 58	156
New York and New Jersey	327	1,717	37	5,465	45	11,500	13	84	85
Central Pennsylvania	317	448	16	2,578	20	2,591	24	1 47	100
Colorado	294	294	6	1,151	6	7,194	18	4 52	114
East Tennessee	186	192	7	708	21	1,650	20	1 77	90
Missouri and Kansas	186	186	6	3,096	....	4,700	25	6 31	96
Missouri Bell	74	107	3	2,100	21	2,840	21	5 63	43

The high average in gross receipts of the Colorado Company may perhaps be accouted for by the fact that in Colorado the lines traverse a large district not reached by telegraph lines, and written messages are handled. The Missouri & Kansas Company state that their "odds and ends" in toll lines are not accounted for, and possibly their very high average in earnings may be due to this fact. The longest line worked regularly and successfully is again reported by the Wisconsin Telephone Company, and I desire to offer especial assurance that this figure is not the result of guesswork. In the reports of toll line expenses the figures differ too widely to be of value in a comparative statement. It may be said, however, that thirty-three and one-third per cent. of the gross receipts is not a high estimate for toll line expenses; some companies, indeed, show averages of forty and fifty per cent. The possibilities of service on a single wire have been reckoned at eighty messages per day. While one or two companies, most successful in this work, report daily averages of their busiest wires, at forty and sixty messages, I think an average of twenty messages per day each will be found nearly correct, as representing the present work of what we call busy wires. At an average rate of twenty-five cents per message a busy line will earn $3.33 per day, after deducting thirty-three and one-third per cent. for operating expenses. At a cost of $75 per mile, such a line may be

133 miles long, and pay a return of ten per cent. on the investment. It frequently happens that there are demands for service between important points, which ten wires would not accommodate. Such demands, however, come only at the busy time of day, a period usually not covering more than three hours; and if ten wires were provided the majority of them would be idle the greater part of the day. As comparative with a twenty message per day average for one wire between two busy points, I doubt if a system of five wires would average more than fifty messages per day, or ten for each wire, thus reducing the ten per cent. investment limit to sixty-six miles. The margin for profit in the present lines may be found in the facts that some lines cost less than $75 per mile, and are less than the above limits in length, and do average twenty or more messages per day.

The present approved telephone line, for single wires, may be said to be of hard drawn copper wire, weighing from 100 to 300 lbs. to the mile, strung on glass insulators, with thirty cedar poles to the mile, the poles to be at least twenty-five feet long, five inches in diameter at the top, and set four feet in the ground.

It is quite remarkable that in the past year nothing new has been developed regarding the "induction" phenomenon, and no practical remedy has been found for this uncertain and unfortunate evil. During the past four summer months it has been noticed throughout the Northwestern States that there has been less trouble from noisy wires than ever before during the same season. Extended inquiry and pretty constant observation has established the truth of this assertion. The reason for this I attribute to the unusually dry season. There has been apparently but little difference in the electrical condition at different points, few storms, clouds or electrical phenomena of any character. The crust of the earth has been baked hard and dry, forming a most imperfect conductor for the equalization of tension. The swamps and low places have become dry, and even the streams have diminished in size. Owing to the above causes the currents usually traversing these surface conductors, earth, water and air, have become of less volume and intensity, and the effects, as produced in the telephone, have decreased in like proportion. In further support of this theory I desire to cite an instance of a line fourteen miles long, formerly extending along the bank of the Chippewa river in Wisconsin, connecting two exchanges, and much used. This line was the very noisiest I have ever known. During the summer months it gave forth a variety of sputtering and frying noises continuously, day and night, and was a great annoyance. Last Fall we were obliged to change the route of the line materially, and I determined to abandon the river bed and get up on the high ground, thinking only to escape lightning troubles and washouts. Much to my surprise, this Spring and Summer, I found the new line free from noises and entirely quiet, while the portion of the old line now remaining sputters and fries away as before. It certainly would appear that the river, as a natural conductor, produces the disastrous inductive effects. The "cross-talk" trouble is to-day just as bad as ever, and two parallel wires on one line of poles cannot be worked satisfactorily at the same time, for even a distance of ten miles. While subscribers put up with it and try to get used to it, they certainly do not like it, and the amount of invective hurled at "the man on the other wire" shows no diminution.

As modestly as possible, I desire to lay claim to the discovery of a seemingly ludicrous but really quite effective remedy for "cross-talk." It has for a base an apparent "differential" in the appreciation of any two different languages. When an unsuccessful attempt is being made to work two parallel wires at one time and things are getting warm at each end, instruct your operator to cut out one wire, and then ask the parties on the other if they can speak German, and, if so, have them go ahead entirely in German. Then cut in your second wire and both conversations will proceed without clashing, one being in English and the other in German. There is, perhaps, no limit to the combinations of languages which may be made effective for this scheme, and, as I am uncertain as to whether it is based on the "undulating" or the "make and break" principle, I resign all claim as the inventor. Up to the present time the toll line business of the country has been developed entirely by the single wire systems, with all their disadvantages in delay, inductions, poor results and limited facilities. There has not yet been offered what may be called a perfect or popular toll line service, and the possibilities of such a service have not been clearly shown by the present results. When long distance telephony, in a perfected form, is regarded as much of a certainty as railway travel or the United States mail service, it may be assumed that a different class of patronage will be developed. The perfected service free from distracting annoyances will certainly be regarded as one of the very greatest of modern conveniences, and must receive the most extended patronage of a progressive people.

A. S. HIBBARD.

MR. FAY—I move that the paper be accepted and printed, and that the thanks of the Association be given to Mr. Hibbard.

The motion was carried.

MR. KELLER—I should like to ask the Secretary if those statistics refer solely to the business and the mileage of the extra-territorial lines, or if toll lines are also included?

THE SECRETARY—Not being the author of the paper, and only having seen it as it came to me by mail, I am unable to answer that question positively, but I should infer from the fact that Mr. Hibbard reports the "number of exchanges connected," and also the "number of toll offices connected where there are no exchanges," that the mileage of poles and wires referred to both, to extra-territorial lines, and also to toll lines, where there are no exchanges.

MR. KELLER—I wish to say that the statistics furnished by our company only show the number of miles of wire and the number of connections and the business of extra-terri-

torial lines connecting two exchanges; toll lines and the business of the toll lines are not included. As I understood that to be the question asked by Mr. Hibbard, I answered it accordingly.

MR. DURANT—I would like to ask Mr. Lockwood in what condition is the anti-induction apparatus of Mr. Jackson which was presented by Mr. Lockwood, I think, at the last Convention.

MR. LOCKWOOD—I should be glad to be able to tell, Mr. Durant, but I do not know. I have asked Mr. Jackson about it a great deal, and he says it is very useful on the lines of the Michigan Company, and enables them to keep their long line customers and to increase their remuneration on such lines. I do not think it has gone into use anywhere but in Michigan; but I know of electricians, some of whom are experts of the Bell Telephone Company, who say that it does not work efficiently. That is about all I know regarding it.

MR. SARGENT—In regard to New Jersey, I would say that as we have the lowest rates and lowest earnings per month per mile, perhaps a word of explanation may be interesting. Our territory is peculiar, and comprises one exchange district. Our principal toll business is with New York city, where the rate is only ten cents, and that is largely commuted. That, I think, will explain our extraordinary low rate and the low earning power of the lines.

THE CHAIRMAN—I desire to say for the benefit of Mr. Sargent, that the average monthly gross receipts of the Pennsylvania are less than the New York and New Jersey, being 59 against 84.

MR. KER—It will be noticed that the Pennsylvania is very low indeed. We have within our own territory no centre towards which business gravitates. Our business gravitates to districts *without* our own territory, with which we have thus far not been able to get trunk line connection. The consequence is that our trunk line earnings are at a minimum.

THE SECRETARY—I would like to ask Mr. Sargent if it is not a fact that his returns upon which this table is based, include only the proportion of the receipts for toll messages which belongs to the New York and New Jersey Company, and not the larger per cent. which is paid to the Metropolitan Telephone Company, of New York, for the use of the cables across the North River.

MR. SARGENT—I rather think not. I think that those figures include the gross earnings, including the New York proportion. I did think when I first looked at them that we had simply given our proportion of those receipts. But I gave Mr. Hibbard both figures with the intention that he should give the *gross* receipts, which would be the correct figure for the lines in our district.

MR. FAY—I think that our returns were made on the basis of our own business; that is, where our business passed into the territory of another company, say the Wisconsin Company's territory; we gave the figures of our own receipts for our own territory and omitted the figures for the Wisconsin territory. Of course it would reduce the gross volume of business passing over the line between us and the Wisconsin Company. But as the Wisconsin Company would probably report their receipts from our line, that would even the thing.

It is suggested to me by Mr. Hibbard's paper, to state my experience in the maximum use of the line. Mr. Hibbard said that he thought twenty connections a day was a fair average for a busy line. Our busiest wires are those between Chicago and suburban towns, where we have exchanges in the immediate neighborhood, and those towns are so much dependent on Chicago, that there is almost as much Chicago business as local business derived from the exchanges. We find on those lines, 12 or 15 miles long, and which we can use with absolute certainty, that we can get from 25 to 30 connections a day, and upon the longer lines, where talk is less satisfactory by reason of more cross-talk, that the daily number of connections runs down very considerably; therefore, I think Mr. Hibbard's statement of twenty connections a day is not very far out of the way.

MR. KER—I will take the liberty of saying, that during the prevalence of electrical storms on our line from Harrisburgh to Reading, a distance of 54 miles, we have been totally unable to hear by listening on the telephone with two hand-phones in the ordinary way. By the insertion on the line of one of Van Rysselberghe coils of a resistance of 500 ohms, at one end, speaking has become distinctly audible, and the noise very much less, although the speaking comes more faintly. A coil of 500 ohms is the resistance which Van Rysselberghe has decided upon for insertion on telegraph wires. He intends that, with condensers, to be put on the telegraph lines when the telegraph lines are on the same poles, but as we could not induce the telegraph companies in our neighborhood to put in such coils and condensers on their lines without our making some returns to them, which we were not disposed to do, we had only an opportunity to try experiments on our own line. I believe if the Bell Company or Mr. Lockwood would give a little attention to the resistance of the coils most suitable for the telephone, it would be found that a coil could be constructed and put upon a telephone line, which would not weaken the current too much, while at the same time it would have sufficient influence to diminish the noise. I have no doubt that for telephone purposes a much better resistance and a much better proportion of wire to coil than that of the 500 ohm coil can be determined. The 500 ohm coil is intended, as I have said, to be put on a telegraph line, and not on a telephone line. Possibly Mr. Lockwood has given some attention to it already, and I should be very glad to hear from him.

MR. LOCKWOOD—I would like to ask Mr. Ker whether the coils he speaks of have cores in them, or whether they are simply resistance coils.

MR. KER—Yes, sir; they have cores.

MR. LOCKWOOD—Then they are substantially the same that Mr. Jackson recommended, and is using.

MR. SARGENT—I tried the Jackson coil on some of our wires, and found that it quieted the disturbance to a very

great extent, but I also found that by inserting a little more of resistance, such as is in the rheostat, you could quiet the noise, I should say, quite as effectually. Of course, a resistance coil would be all the better for having a core. But I did not have a coil made in that way to carry the experiments any further.

THE CHAIRMAN—What effect, if any, did it have on the volume of sound?

MR. SARGENT—It reduced the volume of sound, but increased its clearness and sharpness. The reduction in volume was not great enough to be a serious inconvenience, and the clearing-out of the disturbing noises was very noticeable, indeed.

MR. LOCKWOOD—I wish I could agree with Mr. Sargent; that is, I wish my experience would agree with his. I have found that it does not matter much as to telephonic sounds how much rheostat resistance there is in a line. In the few experiments I have made I found I could introduce 10,000 or 100,000 ohms, and it did not make much difference, but when I put a core in the coils the difference was very pronounced, indeed; as he says, the tendency was to reduce both the noises and the telephonic sound, and to cut off the tailings of the telephonic conversation and bring the syllables out sharply. My belief is that the core has more to do with it than the coil, because I believe that the effect is caused by the magneto counter-currents.

THE CHAIRMAN—Mr. Sclater, would you favor the Convention with your experience in long distance telephoning?

MR. SCLATER—I cannot speak of electrical, but simply of commercial results. The Bell Telephone Company of Canada has about 3,600 miles of trunk line wire, and the result is that they return a profit, allowing for depreciation, of about eight per cent. We use No. 14 copper wire, and we have to keep away from telegraph lines, which somewhat increases the distance we have to cover in connecting different points. The No. 14 copper wire is used on the main routes, but we also use No. 9 iron wire to a large extent, and I believe the results from No. 9 iron wire are nearly, if

not quite, as good as from the copper wire; which is, I believe, rather contrary to the experience of most of the people who have spoken to this Convention. The use of our trunk lines around the large centres is very general. They are used largely by commercial travelers in reporting daily the result of their doings, and probably our lines are used more generally than those of other companies. We started in the trunk line business earlier than most of the American companies. I think probably the Michigan company was the only one that kept up with us. We run from Detroit right through Ontario in one line, along easterly of Montreal. I cannot tell the exact mileage of that line, but I can tell you roughly by a little calculation.

MR. LOCKOOOD—What is the furthest distance you work direct?

MR. SCLATER—We work commercially 225 miles. "For five-minute conversations within 15 miles, subscribers pay 15 cts., non-subscribers pay 25 cts.; for five-minute conversations within 75 miles, subscribers pay 25 cents, non-subscribers pay 40 cents; for five-minute conversations within 150 miles, subscribers pay 50 cts., non-subscribers pay 75 cts.; for five-minute conversations within 225 miles, subscribers pay 75 cts., non-subscribers pay $1. Half-rates are charged for each additional 5 minutes beyond the regular time allowed for conversations. Our messages average about 22 cents per message." The business between Hamilton and Toronto is so great that we have six circuits—one of them a copper wire metallic circuit, over which the service is absolute perfection, but only a few of the large users are allowed to use that. That is forty-five miles by the way we go. It is only forty miles by the railway.

MR. SARGENT—Have your lines been built as a venture of the company entirely, or by subscription?

MR. SCLATER—Entirely as a venture of the company. We did at one period, when the finances of the company were not in a flourishing condition, start selling tickets, but we found that the trouble of keeping track of the tickets was greater than the benefit derived.

THE CHAIRMAN—Mr. Hall has had a great deal of ex-

perience in long distance work, and I have no doubt the Convention would be glad to hear from him.

MR. E. J. HALL, JR.—I had hoped to be able to prepare for this meeting a paper which would give a full account of the experiments which have been conducted under my direction, during the past year, with a view of perfecting long distance telephony; but my various engagements have prevented my doing so, and I think, perhaps, it would be better to wait until next year and bring the subject up, and I hope then to lay it before you fully in a paper. The information which I could give you now would be in detachments, and I do not think it would interest you, or be as instructive as the results which we will have next year, from our combined experiments, elaborated in a carefully written paper. I will promise the Association that such a paper will be presented either by myself or some other person connected with our company. I should be glad to answer any questions on particular points which may suggest themselves to any of the members of the Association.

MR. DRAKE—Could not the Association induce Mr. Hall to prepare a paper which could be published in the minutes of our proceedings, giving his experience up to date? The direction in which he is conducting his work is one of great interest to all of us, and I am quite sure we would all like to know what progress has been made in that direction without waiting till next year—that is, if Mr. Hall is at liberty to give his experience and the results.

MR. E. J. HALL, JR.—I would say that all of our work during the past year has been strictly experimental. We have attempted no commercial business whatever, and many of our experiments are not yet fully completed. I should prefer to wait another year, by which time we shall have some absolute results.

MR. DRAKE—We would all like to get as much information in that direction as we could. However, if Mr. Hall is not in a position to give us the information this year, we will have to let it go, I suppose.

MR. E. J. HALL, JR.—I can state this broadly, that we have found in our attempts to carry on long distance telephony,

that it is absolutely necessary in the first place to use a metalic circuit. So far as our present experiments have gone we have obtained no satisfactory results from grounded circuits; that is, between New York and Philadelphia, and the reason for this is, not that we cannot talk on a single wire, with entire success, but when more than one wire is in use the interference between circuits is so great as to render the talking unsatisfactory. We find that by using metallic circuits, the talking over the line between New York and Philadelphia is better than in local telephone communications over grounded circuits. I think that in making that remark, I will be fully borne out by all of the gentlemen of the Association who have talked over that line. The universal expression is that it is very much better than anything that they have ever tried before. Every one expresses astonishment and surprise in talking over the line. Having established our ability to talk, the next problem to be solved is to arrange those metallic circuits so that they can be readily connected. We have succeeded in doing that with entire satisfaction on one end of the line, and we are experimenting in the direction of securing the same satisfactory result at both ends, and have not yet entirely succeeded, although I have every reason to believe we shall do so very shortly. The conversation from either end of the line—the instruments being directly in the metallic circuit—to any subscriber's station located in the exchange at the other end of the line, is entirely satisfactory. At the meeting at Providence the question was raised as to whether there would or would not be cross-talk between metallic circuits. We found that between metallic circuits with wire connected straight through, there was a very considerable amount of cross-talk, not quite as much perhaps as there would have been on grounded circuits, but not materially less. We have entirely removed that by securing a balance between the circuits.

MR. GIFFORD—It seems to me that this whole business is going to be governed in the future from a financial rather than a scientific standpoint. Now there is no one more cordially in sympathy than myself, with the genius of

American inventors, nor with the experiments of Mr. Hall and his associates. I earnestly hope they will succeed, but judging from the information we have obtained in the last few years by reading these annual reports of the business done over the different lines, I think there is a possibility that we are overestimating what is going to come in the future. I think the future will show that our most profitable lines are those of fifteen, twenty, or possibly fifty miles in length, and those which connect suburban points with the business centres to which they are tributary. Now every new inventor is in the habit of announcing that his telephone will talk a thousand miles. We hear frequently of experiments where talking has been carried on between Chicago and New York, and between St. Petersburgh and Berlin, and it is possible in the future that we may get an instrument that will work satisfactorily under favorable circumstances, upon very long lines. But it appears to me that this subject of long distance telephony is going to be controlled by the question of whether it will pay or not. I think it is doubtful if you will ever make long lines profitable. If you were to build a good copper line from here to New York, and give it to me, if I would agree to keep it in order and run it ten years, I do not think I would take it as a gift. I think the proper field of telephony is on lines perhaps 50 or 75 miles long, possibly a hundred. But I believe that the money we are going to make out of this thing is in the lines connecting suburban points with centres. We built our half of the line from Louisville to Cincinnati two years ago. My friend Stone, of Cincinnati, has not had enough confidence in it to come out and meet us yet. Between New York and Philadelphia, or between New York and Washington, perhaps, during the session of Congress, you may have a large amount of business. But I do not believe in connecting points that are not intimately associated in business. I do not wish to cast any cold water on the idea, but I do not wish too extravagant ideas as to the future to prevail.

MR. LOCKWOOD—I think there are not many common interests between Cincinnati and Louisville.

MR. GIFFORD—I question whether a line would pay between here and Chicago.

MR. DURANT—I do not think there is any question but that a line between New York and Chicago would pay.

MR. GIFFORD—Such a line would pay, because they are the eastern and western centres.

MR. SARGENT—It seems to me logical to expect that we might get profitable earnings on lines between large cities I hear that in Missouri and Kansas the connecting up of little villages leads to moderately profitable returns. I think the logical inference would be that larger cities, if connected, would produce corresponding results.

THE CHAIRMAN—Possibly the villages you speak of have not telegraphic facilities.

MR. SARGENT—I do not think we ought to consider the telegraph at all. It is a totally different service from that of the telephone. A man can afford and is willing to pay more for telephoning than for telegraphing.

MR. DRAKE—Our experience in the Nebraska Company rather confirms Mr. Gifford's idea that long distance telephony hardly pays. We have modified our tariff, charging less for short line and more for long line work. I would certainly like to get a report from the Kansas Company giving us the total mileage of their wire. I understand that they left out some of their "odds and ends" of lines. If with these "odds and ends" included in their mileage they could still show large returns, it would be a very encouraging showing.

MR. SMITH—With regard to the Missouri & Kansas leaving out their "odds and ends," I would say that I simply answered a personal letter of Mr. Hibbard's, giving him the result of what we call our Kansas City system—our six exchanges, Topeka, Lawrence, Kansas City, Leavenworth, Atchison and St. Joseph. Those six exchanges are connected by 150 miles of wire, that being the total distance between the exchanges. The figures I gave him covered our mileage and business before we had built some second wires, which would complicate calculations. I gave him our figures previous to that time. We have a good business there, and

are not much in competition with the telegraph. We are doing more business, I think, between those cities than both telegraph companies do. We attribute our success in being able to handle the business, to the good condition of our line, and a good deal to the manner in which we handle it—I mean the manner in which our operators handle the business with the subscribers. We believe it is just as important for us to observe uniformity in our conversations over the line as telegraph people do in being uniform in the manner in which their messages are sent over the wire. For instance, when a subscriber asks for a connection to a distant point, if the operators are left to themselves, they almost always say: "Who are you?" or "Who is it?" That is irritating, because it does not explain itself; what the girl wants to know is, to whom it is to be charged. Therefore, we have adopted the question: "Who is this to be charged to, please?" It explains itself at once, and prepares the way for the next question: "Who is talking?" We note that on the ticket, and then ask for the name of the party that is wanted. Besides not irritating the subscribers, it gives us the name of the party doing the talking, which facilitates our collections. If we are not able to supply that order at once, and have to wait four minutes or five minutes for the connection, we know who it was that wanted to use the instrument. After we adopted this formula, we were able to show a very decided increase in our business. We also noticed an increase after using the long distance transmitters.

It enables the operator to handle her business communications with more ease, thus saving time. Our business has so increased that we have had to build a second wire between Kansas City and Leavenworth, and a second line between Kansas City and Topeka. Our last wire between Kansas City and Topeka is over eighty miles in length —a copper wire. It talks very nicely. We anticipate a handsome increase in our business.

THE CHAIRMAN—Are you troubled any with earth currents on those lines in Kansas?

MR. SMITH—I don't know that we are, to any extent.

THE CHAIRMAN—Do you notice that there is more disturbance on certain days than on others?

MR. SMITH—No, sir. We only notice disturbances on the approach of a storm. As Mr. Hibbard remarked in his paper, this summer has been favorable to us in the West. We have lost very little use of our lines by reason of any extraneous currents.

MR. E. J. HALL, JR.—I would like to call attention to just one point of Mr. Hibbard's paper, which, I think, should hardly be allowed to go on the record without entering a word of dissent; that is, in regard to his specifications for the construction of lines. He says, I think, either that he *recommends*, or that the average *practice* has been, to construct 25-foot pole lines, 5 inches in diameter at the top. It seems to me that we have all made mistakes in the direction of constructing too small lines, and I know that, in the case of the Buffalo Company, at least, we are going through a very extensive system of reconstruction, which involves the expenditure of a large sum of money, which might as well have been saved if we had had a better conception of the requirements of the business at the outset, and had better prepared ourselves to meet them. It seems to me that these little bean-pole lines should never have been constructed, because they represent simply wasted money. They must eventually be replaced with other and more substantial lines.

MR. EASTABROOK—I simply desire to say in confirmation of Mr. Sargent's idea, that the most profitable and busiest line that we have is a 40 mile line, over which our rate is 35 cents, and the Western Union and Postal rate for the same distance is 10 cents for ten words.

MR. SEELEY—I would also say that in New York city we receive and send about 4,000 pay connections a day, and most of those are delivered to Mr. Sargent's territory. The telegraph rate is much cheaper than the telephone rate, but we have all the business we can handle. We could probably increase the toll business if we had more trunk wires.

MR FAY—I think that Mr. Smith's remarks were entirely

in the right direction. I believe that between any two cities in America a limited business can be developed if the service can be made certain and accurate, and the price should be made high enough to cover that limited demand. All business does not come over the telegraph. It comes, rather, from the mail. It is when a man's communication is not positive and direct, so that he can telegraph it, but when it is an inquiry, to be answered, to result in a modified order, or a second inquiry, and another answer, and so on—a conversation in short—that is when people are willing to pay for the use of the telephone, if they can get it, and if they can be sure of getting the man they want to talk to. The principal difficulty we have had in promoting a large toll service business in Chicago, and I suppose the same is true in all large cities, is to get hold of the man and the wire that you want, at the instant the party calling wishes it. I will give you an illustration that came to my notice the other day. A man at Lake Geneva, Wisconsin, 90 miles from Chicago, calls for a wholesale grocery in Chicago. He gets the grocery and he wants to talk to one particular salesman, whom he is in the habit of buying from. The salesman is out, and the man at Lake Geneva leaves word to call him when the salesman comes in, and he pays for his connection 40 cents, that being our rate. He has not a telephone himself, and his little grocery is at some distance from our pay station. By and by the salesman comes in, and finds a memorandum on his desk to call up Lance at Lake Geneva. He calls him up and Lake Geneva sends a message to Lance. Lance comes to the telephone office fifteen or twenty minutes later. He calls up Chicago, and finds that the wholesale grocery is busy talking to somebody else. He pays for the messenger sent for him, and goes back to his store, saying, "I cannot wait now, but when you get the wholesale grocery send for me again." An hour later Lake Geneva gets hold of the wholesale grocery and sends a messenger for Lance. Lance comes to the telephone, and finds his man has just gone out the second time. He refuses to pay for our work done in the meantime. Now, that is a

practical difficulty. We have done the work; our instruments have done their work, and yet the man has not got his communication, and does not want to pay the charges. Between small suburban towns and cities at small distances, these difficulties can be obviated, but when we come to long distance communication, as between Chicago and New York, we have an expensive line that is being occupied in wasted time. How shall we get around that difficulty? The only way I can see would be for a man in Chicago who wanted to talk to a man in New York, to engage the line for a certain hour—say 11 A. M., and telegraph the man in New York to be at the office at 11 A. M. But to attempt to transact a general exchange business with all the cities of the coun try, and expect to get a ready and accurate exchange service, seems to me impossible.

MR. EASTABROOK—To obviate to some extent the difficulties that Mr. Fay has just suggested, I will tell the gentlemen the plan the Central New York Company has adopted. If a non-subscriber comes to the office in one of the country towns to talk to one of the large centres, they require at once, before the call is made, a deposit of the amount of the toll. If the call is made, and if, through no fault of the telephone company, the party is not got hold of, one-half the amount is refunded, and the other half is kept as pay for the service. If the call is perfected the full amount is retained. In any event they get some return for the use of the line. It has worked so successfully with the Utica Company that we are adopting the same plan.

MR. DRAKE—The Nebraska Company have a plan to obviate those difficulties. We have what we term a *call* service, for which we charge ten cents. When a party calls we charge ten cents, and we make the appointment then and there, instead of doing it by telegraph. When the connection is made we charge full toll.

MR. FAY—It has struck me that, as between large cities, a call service might be organized. I have thought this over, and talked it over with Mr. Hibbard, of Milwaukee. The plan would be to have toll stations, conveniently located, with

long distance transmitters, metallic circuits, and prepared to do a first-class toll business, so that a subscriber in one city could go to the nearest toll station, call up the distant city, get his party by the call service, and without the necessity of taking the risk of exchange connections. By means of a call service, in that way, you might get satisfactory results on toll lines; but I do think that the attempt to throw the great exchanges into a toll system is an extremely difficult problem.

MR. BAILEY—I understand that the statistics as to the earnings and capacity of these extra-territorial lines are made up by the gentleman from the actual experience as gathered from the different companies. Now, that experience is based on all kinds of lines, some lines that work badly. I cannot see why, if you can make a long line work well, it is not as handy as a short line. Mr. Fay gives us to understand that his profitable lines are his short lines that run out 10 or 15 miles. They are profitable, I believe, because they are more easily handled—because they are efficient lines. Now why can't we put up lines of certain longer distances, that will work as well as our city lines and give as rapid service? If so, why need a line of that kind be confined to 20 connections a day? I claim that it is all a matter of construction, and if we can build lines that will average not only 20 connections a day, but a hundred, it is best to put our money into them. I think there is a great future for long distance telephony, after we have got down to a point where we know how to handle it.

THE CHAIRMAN—I would say to the Association that I am glad that this question has been discussed so thoroughly, especially in reference to what I would term the system of rates for toll charges. Now, in Pittsburgh, we pursue a course entirely different from what I have heard any of the gentlemen mention. We charge for every connection we make. For instance, a subscriber comes to the office and calls for the city of Wheeling. He wants John Smith, a particular individual, also a subscriber. We connect the office of John Smith; but if he wants to talk to John Brown,

a salesman in John Smith's employ, who is not in the store at the time and refuses to hold conversation with any one else in the office, we consider that we have done our duty, and we charge for the work. If Mr. Brown comes into the office and sends a message to Pittsburgh, we charge again 25 cents. If a customer comes into a toll station and calls for a non-subscriber, we charge him 25 cents for the first connection, then the messenger charge, and when we bring the party to the telephone we again charge him 25 cents, virtually making our charge 60 cents, and we do that upon the principle that we do not think we should do this work for nothing. We have performed our duty when we connected the office of the subscriber, John Smith, and the party calling has the option of either giving his message for John Brown to some one else, or not giving it, just as he chooses. In case of non-subscribers we charge the additional 25 cents, as we think there ought to be some discrimination made between subscribers and non-subscribers. We charge for every connection that we make, and if we have to send out for a man and it takes 15 or 20 minutes to get him to the telephone, we call it a second connection, and charge accordingly. It seems to me it would be a good idea if some uniform system could be adopted by all the exchanges throughout the country, so as to have certain uniform system in regard to charges.

MR. FAY—I should judge from what you say, Mr. Chairman, and from what Mr. Eastabrook says, that my illustration was misunderstood. I did not base my statement of the difficulty upon the fact that I had any trouble in collecting the charges for these messages. After the explanation was made to the man he paid the charge without any difficulty. The trouble was in getting the service for the man. Now he was persistent and stuck to it. Nine out of ten men would have gone off immediately and that would have ended the business.

THE CHAIRMAN—I would merely say how very often it happens that people come to the city of Pittsburgh and say, "Out in Ohio or Indiana, or Illinois, in the territory of the

Central Union, or in the territory of the New York and Pennsylvania, they will send for a man and bring him in half an hour afterwards and do not charge anything for sending for him."

MR. EASTABROOK—We *do* charge a messenger fee for such service.

THE CHAIRMAN—The question is, whether we are not justly entitled to a new charge for the second connection. We have to do the work. It seems to me we could in that way make extra territorial lines more profitable than what they appear to be at present.

MR. DRAKE—I would say in explanation of the Nebraska Company's charge that where we give the line to a customer we charge full rates always, no matter whether he gets the particular party he wants to talk with or not. A gentleman will come to Fremont and say, "I want John Smith, of Burke Brothers." We send this message to our Omaha office that John Smith is wanted at the telephone at 11 o'clock. We charge ten cents for that. At 11 o'clock he is at the telephone and we then charge for the whole service.

THE CHAIRMAN—Do you keep employees for the messenger service especially?

MR. DRAKE—We do. The ten cent charge is only for telephone service. If we have to send out, we charge for messenger service.

THE CHAIRMAN—Do you make the second connection for the one charge? Do you charge for the service?

MR. DRAKE—We charge for the service, just the one charge.

MR. SMITH—As confirming Mr. Hall's remarks about better construction, I want to say that our lines between Kansas City and Topeka are 36 poles to the mile, No. 8 iron wire. In two years I do not think we have lost over two half days (excepting the time of our cyclone), when we lost, I think, two days right in the city. That line is always ready for use, and we have averaged for a month as high as 71 messages a day over that circuit. I find some-

times we have had six or seven calls or talks within a half hour. I think this speaks in favor of the idea of Mr. Hall.

MR. E. J. HALL, JR—It occurs to me that it possibly may be of interest to the members of the Association to know what sort of a line we have built between New York and Philadelphia. The line is of 45 foot poles, made for seven cross-arms. The cross-arms are intended to carry ten wires each, and we have now on the line one No. 8 wire on the top pin and twenty-four copper wires. We have twelve No. 14 standard gauge—102 lbs. to the mile; eight No. 12 standard gauge, about 175 lbs. of copper wire to the mile, and four wires of No. 16 standard gauge, about 66 lbs. to the mile. We put these different sized wires on for the purpose of experimenting; to see whether we obtained materially better results from the use of the larger conductor. The capacity which these wires gives us for business will enable us when we commence service to give it promptly and efficiently.

MR. EASTABROOK—Would you prefer, judging from your experience, to use No. 12 rather than No. 16?

MR. E. J. HALL, JR—There is no perceptible difference in the talking between New York and Philadelphia between the No. 16, No. 14 and No. 12. I think that a person talking on one of the wires, and then being switched without his knowledge to any of the others, would not notice any change. The distance is about one hundred miles of pole line and a little over three miles of submarine cable. But when we couple the wires back so as to make longer circuits, we begin to notice a difference. I consider that for one hundred miles No. 16 copper wire is large enough. Beyond that it is desirable to use a larger size. Even with two hundred miles of wire, the No. 16 gauge answers nicely, and I think you can take a metallic circuit of 300 miles of No. 16 standard gauge copper wire, and carry on a thoroughly good conversation. But there are mechanical objections to using such a small gauge. It is questionable if a No. 16 wire in the course of time will be found to be sufficiently durable to justify its use in any case. I think as a standard for trunk

lines it would be perfectly safe to take the No. 14 wire, of about 100 pounds copper to the mile, both for electrical and mechanical reasons.

MR. BAILEY—I would inquire of Mr. Hall the minimum number of poles to the mile that can safely be used with copper wire; whether thirty poles to the mile is sufficient for a line of copper wire, or whether thirty-five should be used?

MR. E. J. HALL, JR—I should not build any line with less than thirty-five poles to the mile. The standard for our work is forty—an average of forty poles to the mile.

MR. KER—I would also ask Mr. Hall whether he puts his wire around the insulators or ties it merely with tie wires.

MR. E. J. HALL, JR—The wire passes directly through, and is fastened with a soft tie wire to the insulator. We use the McIntyre joint for connection. We find it the best thing. Before adopting that we made a series of experiments at the mechanical department, and found that the McIntyre joint gave us the maximum strength of the wire; that is, a wire jointed with the McIntyre joint was as liable to break at any other point on the wire as at the joint. The Britannia joint and the American twist joint, soldered, showed a loss of ten to twenty per cent. from the maximum breaking strain of the wire. Another point in favor of using a joint that can be made without solder, is that it is almost impossible to compel the average lineman to make a joint properly. I do not believe that one repair connection out of fifty is soldered, even with companies where the soldering of joints is supposed to be an absolute requirement. The requirement cannot be enforced.

THE CHAIRMAN—If there is no further discussion, we will pass to the reading of the paper by Mr. Henry Flad, which will be presented by Mr. Durant.

MR. EASTABROOK—Pending Mr. Durant's return, as he seems to have stepped out for a moment, I beg leave to offer the following resolution:

"*Resolved*, That the thanks of this Association are hereby tendered to the Bell Telephone Company, of Missouri, and to its General Manager, George F.

Durant, Esq., for the interesting and enjoyable steamboat excursion to Crystal City, and for numerous other courtesies extended during this annual meeting of the Association."

MR. FAY—I have great pleasure in seconding that motion.

The resolution was carried unanimously.

MR. CHERRY—It seems to me that in pursuance of your action authorizing a transfer from honorary to associate membership, and in view of the fact that very few of our honorary members are now present, the Executive Committee should be authorized to make that transfer. I therefore offer the following resolution:

"*Resolved*, That such of the present honorary members of this Association as may desire to be transferred from honorary to associate membership, may, upon notifying the Secretary of their desire for such transfer, and upon approval of the Executive Committee, be so transferred.

The resolution was seconded, put and carried.

MR. DURANT—After our unfortunate experience of last night, it seems almost an infliction to ask the gentlemen present to listen to a very long paper, and one which may not be of interest to all of you. It has a special application to our own city here, inasmuch as its author is the President of our Board of Public Improvements. A brief canvass about two hours ago led me to believe that the sense of this meeting would be that the reading of the paper be deferred, and that it be published in the minutes. If, however, you desire to hear it, I will attempt to read it.

Mr. Fay here took the chair.

THE PRESIDENT—I would suggest that Mr. Durant give us a synopsis of it.

Mr. Durant then gave a synopsis of the paper, which describes a system of carrying the wires of an exchange in aerial cables, suspended from other supporting cables, the latter being sustained by iron towers placed at the intersection of cross-streets, one tower to each block or one to every two blocks, according to the number of cables to be carried. These towers are to be about ninety feet high; their four corner posts are to stand on the four corners of the intersecting streets, so that the towers will offer no obstruction

to the passage of vehicles, and the cables being above the house-tops will not be unsightly, and will not interfere with the operations of the Fire Department in case of fire. Provision is made for distributing the wires to the subscribers' station, and for a car or cage which traverses the cables from tower to tower, thus enabling the linemen to make any necessary repairs to, or changes in the lines. The details of the plan are ingeniously and thoroughly worked out, and every possible contingency of the construction seems to be provided for.

The Secretary stated that he had received the application of Mr. Clark B. Hotchkiss for associate membership, and that the application had received the approval of the Executive Committee.

THE PRESIDENT—Under the resolution of this morning, I understand that the action of the Executive Committee will be final.

THE SECRETARY—No, sir; this is not a case covered by that resolution. Mr. Hotchkiss has never been an honorary member. This is a new application for election as an associate member.

MR. HOTCHKISS—I desire to say, on behalf of this application, that Mr. Day has been, and is still an honorary member, in his own name, and I have been representing him. Mr. Day has never been at the meetings and has been out of the country for years.

On motion, Mr. Hotchkiss was unanimously elected an associate member.

THE PRESIDENT—We have received from Mr. Berthon, of the Paris Telephone Company, some maps and publications, a list of subscribers, a general review of the telephonic situation all over Europe, Great Britain, etc. They are the same as referred to in his letter, which was read yesterday and have just arrived. They lie on the Secretary's table, and are open for inspection by the members. The Secretary will thank Mr. Berthon for sending them (See Appendix A).

MR. CARSON—I wish to say that I sent by telegraph to Charleston this morning an order to pay over $270 as a result

of the subscription by the members of the Convention.* I expected to have received a telegraphic response by this time, but it does not seem to have arrived.

THE PRESIDENT—If it arrives in time, it can be included by the Secretary in the minutes of the meeting. (See Appendix B.)

On motion of Vice-President Metzger, the meeting then adjourned *sine die.*

C. H. BARNEY,
Secretary.

NOTE.—The next meeting of the Association will be held in Pittsburgh, Pa., at a date to be hereafter fixed by the Executive Committee.

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*Subsequent contributions increased this amount to $285.

APPENDIX A.

Translation of an extract from a French pamphlet received from M. Berthon, of Paris, giving a general review of the telephone situation in Europe:

The publication of the statistics of telephone exchanges, about three years ago, by "La Compagnie Internationale des Téléphones," met with great success. It was, in fact, the first publication combining all the information relative to the telephone business, which was, even at that time, in so flourishing a state as to give to its study a particular interest.

Since that time the applications of the discovery of Bell have greatly increased, and its practical workings have been developed, while at the same time the grounds upon which it rests have become more firmly established, until in most countries the telephone has acquired a very important position. As the situation has thus changed, we think it will be useful to summarize it in more recent statistics.

For two reasons our present researches have been mainly confined to Europe. First, the European business is to us the more interesting, because it directly touches and exerts a certain influence upon our daily life. Second, the distance of other countries from us, and the multiplicity of telephone companies and exchanges—notably in the United States—present great difficulties to the prosecution of our researches. Nothwithstanding any efforts that we might make, and any time that we might devote to their preparation, the statistics which we should present concerning the business in the United States would, probably, be found incomplete. In that country it is estimated that the total number of subscribers is in the vicinity of 340,000, and the capital engaged in telephone enterprises reaches the sum of five hundred millions of francs.

Since the year 1883 the extension of telephone exchanges almost everywhere has been marvelous, as may be seen by a comparison of the results then obtained with the actual results at the present time.

Countries.	Jan. 1, 1883.		Jan. 1, 1886.	
	Number of Exchanges	Number of Subscribers.	Number of Exchanges.	Number of Subscribers.
Germany	21	3,613	91	14,733
Austria	3	870	11	3,032
Belgium	6	1,941	7	3,365
Denmark	1	516	2	1,370
Spain	3	....	3	594
France	18	4,437	20	7,175
Great Britain	75	7,287	89	15,114
Italy	13	5,507	16	8,346
Holland	4	1,340	8	2,493
Portugal	2	80	2	350
Russia	6	1,351	20	5,280
Sweden	5	1,554	15	5,705
Switzerland	2	825	36	4,900
Total	159	29,321	320	72,457

But it must not be thought that the telephone has reached the end of its growth ; in several countries, Austria, Spain and Portugal, for example, there is yet a great deal to be done. In cases where local circumstances have retarded the starting of the business, and where private companies have not been organized, the government has provided regulations, but the results, so far accomplished, under government management, do not promise well for the future.

During the triennial period, which has elapsed since the publishing of the last statistics, the legal situation of the telephone industry has, in some countries, undergone a change. In Belgium, legislation has become more defined, and concessions were accorded, September 22, 1883, for a duration of twenty-five years. In France the concession granted to the Société Général des Téléphones was renewed in the month of September, 1884. for a period of five years. In Switzerland the Administration of Telegraphs has purchased the Zurich Exchange, so that, since the 1st of January last, it has held the entire management of the telephone in that country in its own hands. In Spain private enterprise has been unwilling to subscribe to the conditions imposed by the government, and the latter has had to assume charge of the construction and operation of the exchanges.

As has been shown above, the number of exchanges has considerably increased, having grown from 159 to 320. In 1883, only the large cities possessed the telephone ; to-day its employment is almost universal, and it is heard in all the industrial and commerical centres. An interesting fact in this connection is the gradual consolidation of the business. In Italy and in England, the companies formerly in opposition in the same localities have ceased the fight, and have either united or absorbed one another, until, save in Sweden, where Stockholm and Guttenberg each possess two exchanges, the unification is complete. Such a condition is really essential, in order to obtain from the usage of the telephone all the advantages which it brings.

Rates have not materially changed within the past three years, although the subject has often been discussed. It is in the more important cities—those having the most subscribers—that the maximum prices are attained; the reason for this is easy to understand. The advantages of the telephone naturally increase with the territory of the exchange and with the number of subscribers; communication by telephone saves more time when the distance over which such communication is held is greater, and the value of the subscription increases in proportion as the persons with whom we can communicate are more numerous. On the other hand, the larger exchanges are more costly to construct, and the operating expenses (the maintenance of the lines, for example), increases with the number of communications—that is to say, with the number of subscribers. For these different reasons, it is logical that the subscriber in a large city obtains more advantages than one in a less important centre. We do not, then, share the hope, which some persons entertain, of a reduction of rates in the future; we think, on the contrary, that they must be higher in time; this has been the actual experience in the United States.

So far as concerns the apparatus employed in European telephone exchanges, we have no important changes to describe. The styles remain the same, and the slight changes which they have undergone, relate only to the details of their construction. There must be noticed, however, the new aerial cables, experiments upon which—at the exchange at Saint Etienne in France—with a view to the suppression of telephonic induction, appear to have given the best results.

The talking over ex-territorial lines has been very much developed in certain countries. In Germany and England, notably, such lines are operated regularly and reliably between the more important cities. It is curious to note that in this direction corresponding results have been obtained in both countries; in England, where so many companies are free to operate the telephone, and in Germany where, on the contrary, it is absolutely in the hands of the Government.

In Belgium the construction of ex-territorial lines is nearly completed. This we must attribute to the fact that the distance between the cities is inconsiderate. But if the question of long distance talking is theoretically settled, it does not appear to be so practically; in consequence of imperfections in the system employed. it frequently happens that the clearness of the transmission is insufficient, and sometimes it is even impossible to communicate at all between certain cities. In France we only find, after careful tests, with the advantage of the metallic circuit as at present employed, that talking over long lines is surrounded with so many difficulties, that the public are slow to use them, and prefer to hold on to the telegraph.

INTERNATIONAL BULLETIN OF ELECTRICITY.

PARIS, January 10, 1886.

APPENDIX B.

CORRESPONDENCE RELATING TO THE CONTRIBUTION MADE BY THE MEMBERS OF THE ASSOCIATION TO THE RELIEF OF CHARLESTON.

SOUTHERN BELL TELEPHONE & TELEGRAPH CO.,
New York, September 17, 1886.

GENERAL C. H. BARNEY,
Secretary National Telephone Exchange Association,
234 Broadway, New York.

DEAR SIR—I enclose a letter from Captain Dawson of the Relief Committee, Charleston, S. C., acknowledging contribution of $270.00 from members of the Telephone Convention at St. Louis. Fifteen dollars more were received by me after the remittance was made, and that amount was subsequently sent on by me, making a total of $285.00.

Yours truly,

D. I. CARSON.

[ENCLOSURE.]

OFFICE OF THE NEWS AND COURIER,
Charleston, S. C., Sept. 10, 1886.

JOHN D. EASTERLIN, ESQ.,
Superintendent Southern Bell Telephone and Telegraph Co.,
Charleston, South Carolina.

DEAR SIR—Your letter of this date, enclosing check for $270, to cover amount contributed for the Earthquake sufferers by the members of the recent Convention of Telephonists, held at St. Louis, Mo., received. Pray accept my most grateful thanks on behalf of our suffering people. Rest assured that it will be put, as you request, where it will do most good, and that this timely and generous contribution from the members of the Telephone Convention shall never be forgotten. I am,

Yours very truly,

F. W. DAWSON.

APPENDIX C.

OFFICERS FOR THE YEAR 1886–1887.

President,

C. N. FAY, - - - - - - - Chicago, Ills.

Vice-President,

HENRY METZGER, - - - Pittsburgh, Pa.

Secretary,

C. H. BARNEY, - - - - New York, N. Y.

Treasurer,

H. L. STORKE. - - - - New York, N. Y.

Advisory Committee,

For three years—H. N. GIFFORD, Louisville, Ky.
For two years—MORRIS F. TYLER, New Haven, Conn.
For one year—W. A. JACKSON, Detroit, Mich.

Executive Committee,

C. N. FAY, *Ex-Officio* - - - - Chicago, Ills.
R. M. BAILEY, - - - - Williamsport, Pa.
W. D. SARGENT, - - - - Brooklyn, N. Y.
GEO. N. STONE, - - - - Cincinnati, O.
J. N. KELLER. - - - - Boston, Mass.

APPENDIX D.

ROLL OF ACTIVE MEMBERS.

SEPTEMBER 10, 1886.

American Telephone & Telegraph Co., New York City.
Bell Telephone Co. of Buffalo, Buffalo, N. Y.
Bell Telephone Co. of Missouri, St. Louis, Mo.
Bell Telephone Co. of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Chicago Telephone Co., Chicago, Ills.
City & Suburban Telegraph Association, Cincinnati, O.
Colorado Telephone Co., Denver, Col.
Cumberland Telephone & Telegraph Co., Nashville, Tenn.
Chesapeake & Potomac Telephone Co., Washington, D. C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
East Tennessee Telephone Co., New York City.
Empire State Telephone & Telegraph Co., Auburn, N. Y.
Erie Telephone & Telegraph Co., Lowell, Mass.
Great Southern Telephone & Telegraph Co., New Orleans, La.
Hudson River Telephone Co., New York City.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.
New York & New Jersey Telephone Co , Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York City.
New England Telephone & Telegraph Co., Boston, Mass.
Ohio Valley Telephone Co., Louisville, Ky.

Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburgh, Pa.
Rocky Mountain Bell Telephone Co., Salt Lake City, Utah.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven Conn.
Sunset Telephone & Telegraph Co., San Francisco, Cal.
Wisconsin Telephone Co., Milwaukee, Wis.

ASSOCIATE MEMBERS.

American Electrical Works, Providence, R. I.
Hotchkiss, Clark B., New York City.
Standard Electrical Works, Cincinnati, O.
Western Electrical Company, Chicago, Ill.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Washington, D. C.
Bell Telephone Co., Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, George L., New York City.
Bailey, C. E., Havana, Cuba.
Berthon, A., Paris, France.
Callender Insulating and Water-proofing Co., New York City.
Childs, W. A., New York City.
Cheever, Charles A., New York City.
Cassidy, John, Honolulu.
Clark Insulated Electric Wire Co., Philadelphia, Pa
Dana, [illegible], New York City.
Day, A. G., New York City.
Electrical Supply Co., New York City.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington, D. C.
Madden, O. E., New York City.
Phillips, George L., Dayton, O.

Phillips, E. F., Providence, R. I.
Potter, F. I., Pittsfield, Mass.
Pope, H. W., New York City.
Roebling's Sons, J. A., New York City.
Sawyer, W. H., Providence.
See, I. W., Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., Boston, Mass.
Williams, Jr., Charles, Boston, Mass.
Wiley, George L., New York City,
Lemon, C., Wellington, New Zealand,

APPENDIX E.

CONSTITUTION.

(The amendments adopted at the St. Louis and previous meetings are incorporated herein, in their proper places).

ARTICLE I.—NAME.

The name of this Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual, but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, pro vided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of the Secretary and the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—VICE-PRESIDENT.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—SECRETARY.

The Secretary shall keep a record of the proceedings of all the meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—TREASURER.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—EXECUTIVE COMMITTEE.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Seeretary and transmit to the Association all ap plications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting, and the action of this Committee shall not be final, but advisvory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—ADVISORY COMMITTEE.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws, as in their opinion will best further the aims and purposes of the Association.

3. The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, af-

fecting telephone interests, and shall report thereon to the Association with such recommendations as it may deem advisable.

4. It may also consider any question touching the interests of the members of this Association that may be referred to it, and may call for papers or other documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, so far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committee which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other person, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands, beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. The Association at its annual meetings, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting.

2. Special meetings of the Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the constitution, and shall be payable yearly on or before the first day of October in each year for the year ending August 31st, thereafter.

2. The Association may, by resolution adopted by a majority of all the votes of the Association, make assessments on the members thereof, and such assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

ARTICLE XV.—EXPULSION.

Any member may be suspended or expelled for misconduct, or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—AMENDMENTS.

1. This Constitution shall go into effect immediately.

2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

3. Notice of such proposed change shall be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post-office address of each member.

ARTICLE XVII.—HONORARY MEMBERSHIP.

1. Any person nominated by the Executive Committee may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such elections to be by ballot.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

ARTICLE XVIII.—ASSOCIATE MEMBERSHIP.

1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

2. An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments.

APPENDIX F.

BY - LAWS.

(The amendments adopted at the St. Louis and previous meetings are incorporated herein in their proper places.)

ARTICLE I.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—PRESIDENT.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—SECRETARY.

§ 1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

§ 2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the object for which they are called; and shall keep correctly the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

§ 3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

§ 4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipt and disposal upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

§ 5. Shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business, as have heretofore been furnished by the various committees of this Association (Adopted, September 7, 1886).

ARTICLE IV.—TREASURER.

§ 1. The Treasurer shall keep an accurate roll of the members, and shall collect, under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

§ 2. Shall keep regular books of accounts, which shall be open to inspection by any member of the Executive Committee.

§ 3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

§ 4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—COMMITTEES.

§ 1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of this Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said committee, who will, in case it is not deemed expedient to hold a meeting of said committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report with the Secretary.

§ 2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this Committee.

ARTICLE VI.—MEMBERSHIP.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of the Board of its Directors, make application for membership, and shall forward a copy of such proceedings, properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition, when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—Non-payment of Dues.

If any member fails to pay the yearly dues or assessments within one month from the first day of July, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that unless the same are paid within one month thereafter, the default will be reported to the Executive Committee, which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—Amendments.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting, provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—Suspension of Rules.

These rules may be suspended at any meeting of the Association by a majority of all the votes represented at such meeting.

ARTICLE X.—Statistical Committee.

At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be ex-officio chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require.—(Adopted September 16th, 1884.)

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NINTH ANNUAL MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

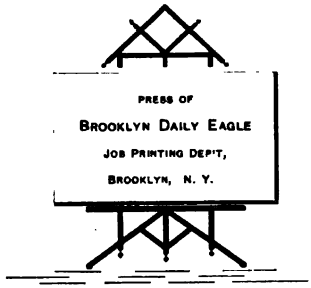
ASSOCIATION,

HELD AT

THE MONONGAHELA HOUSE, PITTSBURGH, PA.,

September 26th and 27th, 1887.

1887.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BROOKLYN DAILY EAGLE
JOB PRINTING DEP'T,
BROOKLYN, N. Y.

NINTH ANNUAL MEETING

OF THE

National Telephone Exchange Association

HELD AT THE

MONONGAHELA HOUSE, PITTSBURGH, PA.

SEPTEMBER 26th and 27th, 1887.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11 A. M., the President, C. N. Fay, of Chicago, in the Chair, and C. H. Barney, of New York, Secretary.

THE PRESIDENT—The Association will come to order. The first business is the calling of the roll. The Secretary will call the roll.

THE SECRETARY—As the roll is called I would be glad if the members present would hand me their cards bearing their names and the names of the companies that they represent.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session.

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Edward J. Hall, Jr., Vice-President and General Manager; Angus S. Hibbard, General Superintendent.

BELL TELEPHONE COMPANY OF BUFFALO, Buffalo, N. Y.—Edward J. Hall, Vice-President and General Manager.

BELL TELEPHONE COMPANY OF MISSOURI, St. Louis, Mo.—George F. Durant, General Manager.

BELL TELEPHONE COMPANY OF PHILADELPHIA, Philadelphia, Penn.—Samuel M. Plush, General Manager.

CENTRAL DISTRICT AND PRINTING TELEGRAPH COMPANY, Pittsburgh, Penn.—Henry Metzger, General Manager; M. R. Wolff and W. D. Paynter, Superintendents.

CENTRAL PENNSYLVANIA TELEPHONE AND SUPPLY COMPANY, Williamsport, Penn.—R. M. Bailey, General Manager.

CENTRAL UNION TELEPHONE COMPANY, Chicago, Ill.—George L. Phillips, President; F. G. Beach, Treasurer.

CHICAGO TELEPHONE COMPANY, Chicago, Ill.—C. N. Fay, 2d Vice-President and General Manager.

COLORADO TELEPHONE COMPANY, Denver, Col.—E. B. Field, General Manager.

CHESAPEAKE AND POTOMAC TELEPHONE COMPANY, Washington, D. C.—Samuel M. Bryan, President.

CENTRAL NEW YORK TELEPHONE AND TELEGRAPH COMPANY, Utica, N. Y.—H. L. Storke, President.

DELAWARE AND ATLANTIC TELEPHONE AND TELEGRAPH COMPANY, Philadelphia, Penn.—W. T. Westbrook, Superintendent.

EMPIRE STATE TELEPHONE AND TELEGRAPH COMPANY, Auburn, N. Y.—H. L. Storke, President.

ERIE TELEPHONE AND TELEGRAPH COMPANY, Lowell, Mass.—J. W. Bennett, President; Charles J. Glidden, Treasurer; J. W. C. Pickering, Director; J. P. McKinstry, General Manager; J. K. Dunbar, General Superintendent Southwestern Division.

HUDSON RIVER TELEPHONE COMPANY, New York City.—A. B. Uline, Vice-President and General Manager; H. L. Storke, Treasurer.

METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—J. A. Seely, Electrician.

MISSOURI AND KANSAS TELEPHONE COMPANY, Kansas City, Mo.—Charles W. McDaniel, Superintendent; J. W. Ebert, Manager.

MICHIGAN TELEPHONE COMPANY, Detroit, Mich.—F. A. Forbes, General Superintendent.

NEW YORK AND NEW JERSEY TELEPHONE COMPANY, Brooklyn, N. Y.—W. D. Sargent, General Manager.

NEW YORK AND PENNSYLVANIA TELEPHONE COMPANY, New York City.—W. N. Eastabrook, General Manager.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, Boston. Mass.—W. J. Denver, General Manager.

OHIO VALLEY TELEPHONE COMPANY, Louisville, Ky.—H. N. Gifford, General Manager.

PROVIDENCE TELEPHONE COMPANY, Providence, R. I.—A. C. White, Superintendent.

PENNSYLVANIA TELEPHONE COMPANY, Harrisburgh, Penn.—J. B. Ker, General Manager.

SOUTHERN MASSACHUSETTS TELEPHONE COMPANY, New Bedford, Mass.—Samuel Ivers, Treasurer.

SOUTHERN NEW ENGLAND TELEPHONE COMPANY, New Haven, Conn.—Morris F. Tyler, President.

ASSOCIATE MEMBERS.

AMERICAN ELECTRICAL WORKS, Providence, R. I.—P. C. Ackerman, Agent.

HOTCHKISS, CLARK B., New York City.

STANDARD ELECTRICAL WORKS, Cincinnati, O.—E. V. Cherry, Vice-President.

WESTERN ELECTRIC COMPANY, Chicago, Ill.—J. M. Jackson, C. A. Brown, H. B. Thayer, Geo. L. Beetle, W. R. Patterson, C. E. Scribner, F. W. Harrington.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE COMPANY, Boston, Mass.—Thomas D. Lockwood, Thomas B. Doolittle, J. M. Brown, A. O. Morgan, D. B. Parker, George Albree, William A. Hovey.

BRIDGEPORT BRASS COMPANY, Bridgeport, Conn.—Henry D. Stanley.

BEETLE, GEORGE L., New York City.

CHILDS, W. A., New York City, by Frank Shaw.

CHEEVER, CHARLES A., New York City, by George T. Manson.

DAY, A. G., New York City, by Clark B. Hotchkiss and Ralph W. Pope.

LOCKWOOD, THOMAS D., Boston, Mass.

PHILLIPS, GEORGE L., Chicago, Ill.

PHILLIPS, E. F., Providence, R. I., by P. C. Ackerman.

WILEY, GEORGE L., New York City.

26 Active, 4 Associate and 10 Honorary members were represented by 59 delegates.

THE PRESIDENT—The next business in order, gentlemen, is the nomination of new members. Are there any nominations to propose?

The Central Union Telephone Company, which two years ago resigned, is nominated as a member of this Association.

On motion, the Central Union Telephone Company was re-elected a member of the Association.

THE CHAIRMAN—The next business is the report of the Secretary.

The Secretary read his report as follows:

SECRETARY'S REPORT.

NEW YORK CITY, September 1st, 1887.

To the National Telephone Exchange Association:

GENTLEMEN:—I have the honor respectfully to submit my report as Secretary of this Association for the year, ending August 31, 1887.

The changes in membership since my last report have been as follows: At the beginning of the Association year we had 34 active and 32 honorary members. Of the former, all remain on the roll, although the resignations of two of them, viz.: the Great Southern Telephone and Telegraph Company, of New Orleans, La., and the Cumberland Telephone and Telegraph Company, of Nashville, Tenn., are in the hands of the Secretary, awaiting the action of the Association. At the annual meeting a year ago, in St. Louis, one new active member was admitted—the Rocky Mountain Bell Telephone Company, of Salt Lake City.

Of the honorary members, three, viz.: the Standard Electrical Works, of Cincinnati; the Western Electric Company, of Chicago, and the J. A. Roebling's Sons Company, of New York, have been transferred to the new class of "Associate" members, established at the last meeting. Two new associate members have been elected, viz.: Clark B. Hotchkiss, of New York, and the American Electrical Works, of Providence, R. I. We close the year with 35 active, 5 associate and 29 honorary members.

The office of the Secretary remained at 234 Broadway, New York, until May 1st of the present year, when the parties of whom desk-room had been hired removed to other quarters, and the office of the Association was located at 32 Nassau street, where it has since remained.

The publication of the *News-Letter* has been continued throughout the year, and seems to be appreciated, judging from the fact, that if the copies mailed to any member fail from any cause to reach him, he usually very promptly writes, stating the fact, and asking that other copies be forwarded. Naturally, he would not do this unless he found the information contained in these semi-monthly bulletins to be of value.

It seems proper at this point to again remind members of the Association how much they can add to the value and interest of the *News-Letter* by promptly communicating to the Secretary any and all matters of news from their respective localities. Coming from such sources, the information would possess the stamp of authenticity, which cannot always be said of newspaper reports.

It was at one time contemplated to publish a roster, or directory of the telephone field in the United States, and nearly all the material for such a work was collected by the Secretary. But, in the opinion of some of our officers, the Association could not properly pay for its printing, and the matter was dropped. As several members have signified their desire for such a directory, it is possible that a sufficient amount of advertising may be secured to pay for the expense of publishing it.

The report of the Treasurer, which is herewith submitted, is a gratifying

one, inasmuch as it shows the Association to be solvent, and that its expenses for the past year have been kept practically within its income.

The following is a summary:

Balance on hand last report	$38 35
Receipts of the year	2,024 77
	$2,063 12
Expenditures of the year	2,025 79
Balance on hand at date	37 33

The sources from which our receipts were derived were as follows:

From annual dues	$1,900 10
" initiation fees	55 00
" sales of extra copies of proceedings	69 67
Total	$2,024 77

The distribution of the expenditures was as follows:

For salary of Secretary	$1,200 00
" rent of office	140 00
" printing Proceedings, St. Louis meeting	270 00
" other printing, *News-Letter*, circulars and blanks	151 10
" office expenses, stationery, postage, telegrams and subscriptions to newspapers	108 54
" stenographer at St. Louis meeting	87 80
" other expenses at St. Louis meeting	68 35
Total	$2,025 79

The assets of the Association at the present date are as follows:

Cash in hands of Treasurer	$37 33
Due from Cumberland Telephone and Telegraph Company (dues for 1884, 1885, 1886 and 1887, and assessment for 1886)	120 00
Due from Great Southern Telephone and Telegraph Company (dues for 1887)	50 00
	$207 33

The Association owns about $10 worth of office furniture and a considerable quantity of the printed proceedings of previous meetings from the first to the eighth. On these last no definite value can be placed, although some of them are sold from time to time.

It is pleasant to state that the Association has no liabilities, every claim against it having been paid in full to date.

It is reasonable to expect that next year's income will, in like manner, as the last, suffice for the year's expenses.

Respectfully submitted,

C. H. BARNEY,

Secretary.

THE PRESIDENT—You will now hear the Treasurer's report. The Treasurer's report has been examined and the vouchers have been passed upon by the Executive Committee as usual; so that unless called for by the members of the Association it will not be necessary to read them in detail.

MR. H. L. STORKE (Treasurer)—The Secretary has alluded to the report of the Treasurer as most gratifying. I take that view of it myself, except that the balance on hand last year was $38.35 and this year it is $37.33, a shrinkage of $1.02; and it is also gratifying in another respect that this year I have had to overdraw the account only once, and last year I think I had to beg the indulgence of our bank two or three times. The figures given by the Secretary agree with the figures here, and I have a detailed report, with the vouchers, which, unless called for, I will omit reading. The balance forward to the next year is $37.33, and all bills have been paid.

NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

TREASURER'S STATEMENT, YEAR ENDING AUGUST 31ST, 1887.

RECEIPTS.			DISBURSEMENTS.					
1886.			1886.					
Sept. 9	To balance	$38 35	Sept. 27	By C. H. Barney	Voucher No.	105	$68 35	
" 23	" City and Suburban Telegraph Association, Dues for 1887	50 00	" 27	" " "	" "	106	45 00	
" 24	" Chicago Telephone Co., Dues for 1887.	50 00	Oct. 2	" " "	" "	107	16 95	
" 25	" Metropolitan Telephone and Telegraph Co., Dues for 1887	50 00	" 2	" American Press Information Bureau	" "	109	5 95	
" 25	" Pennsylvania Telephone Co., Dues for 1887.	50 00	" 7	" C. H. Barney	" "	108	100 00	
" 25	" Bell Telephone Co. of Buffalo, Dues for 1887	50 00	" 26	" R'd W. Ryan	" "	110	42 80	
" 27	" Michigan Telephone Co., Dues for 1887.	50 00	Nov. 8	" Jersey City Printing Co.	" "	111	10 50	
" 27	" The Central District and Printing Telegraph Co., Dues for 1887	50 00	" 8	" C. H. Barney	" "	112	100 00	
" 27	" Ohio Valley Telephone Co., Dues for 1887.	50 00	" 8	" American Press Information Bureau	" "	113	2 95	
" 27	" New England Telephone and Telegraph Co., Dues for 1887	50 00	" 8	" C. H. Barney	" "	114	14 65	
" 30	" Southern Bell Telephone and Telegraph Co., Dues for 1887	50 00	Dec. 3	" " "	" "	116	14 60	
" 30	" East Tennessee Telephone Co., Dues for 1887	50 00	" 3	" American Press Information Bureau	" "	118	10 45	
" 30	" New York and New Jersey Telephone Co., Dues for 1887	50 00	" 6	" C. H. Barney	" "	119	100 00	
			" 28	" " "	" "	125	100 00	
			1887.					
			Jan. 7	" Brooklyn Daily Eagle	" "	115	6 50	
Carried forward		$638 35	Carried forward				$638 70	

	Brought forward		$638 35
Sept.	30	To Chesapeake and Potomac Telephone Co., Dues for 1887	50 00
Oct.	2	" Bell Telephone Co., of Missouri Dues for 1887	50 00
"	2	" Hudson River Telephone Co., Dues for 1887	50 00
"	7	" Bell Telephone Co. of Philadelphia, Dues for 1887	50 00
"	7	" American Telephone and Telegraph Co., Dues for 1887	50 00
"	7	" Missouri and Kansas Telephone Co., Dues for 1887	50 00
"	9	" Nebraska Telephone Co., Dues for 1887	50 00
"	9	" Erie Telephone and Telegraph Co., Dues for 1887	50 00
"	12	" Sunset Telephone and Telegraph Co., Dues for 1887	50 00
"	12	" Pacific Bell Telephone Co., Dues for 1887	50 00
"	12	" Callender Insulated Wire Co., Initiation Fee	25 00
"	22	" Rocky Mountain Bell Telephone Co., Initiation Fee	10 00
"	22	" Rocky Mountain Bell Telephone Co., Dues for 1887	50 00
"	25	" Central Pennsylvania Telephone and Supply Co., Dues for 1887	50 00
	Carried forward		$1,273 35

	Brought forward					$638 70
Jan.	7	By Jersey City Printing Co.	Voucher	No.	117	10 00
"	7	" " " "	"	"	120	16 35
"	7	" American Press Information Bureau	"	"	121	8 15
"	7	" Brooklyn Daily Eagle	"	"	122	2 75
"	7	" C. H. Barney	"	"	123	22 32
"	7	" The Electrical Review	"	"	124	3 00
"	18	" C. H. Barney	" pt.	"	131	50 00
"	21	" Brooklyn Daily Eagle	"	"	126	276 25
"	21	" Jersey City Printing Co.	"	"	127	12 90
"	21	" American District Telegraph Co.	"	"	128	2 16
"	26	" C. H. Barney	" pt.	"	131	50 00
Feb.	3	" " "	"	"	129	15 22
"	3	" American Press Information Bureau	"	"	130	6 50
"	18	" C. H. Barney	" pt.	"	136	50 00
Mar.	3	" " "	" pt.	"	136	50 00
"	3	" " "	"	"	133	14 75
"	3	" American Press Information Bureau	"	"	135	3 55
"	17	" C. H. Barney	" pt.	"	140	60 00
April	4	" " "	" pt.	"	140	40 00
"	4	" " "	"	"	138	14 30
	Carried forward					$1,346 90

	Brought forward		$1,273 35
Oct.	25—To Western Electric Co., Dues for 1887		50 00
"	25— " Delaware and Atlantic Telephone and Telegraph Co , Dues for 1887		50 00
"	25— " Standard Electrical Works, Dues for 1887		50 00
"	27— " Providence Telephone Co., Dues for 1887		50 00
"	27— " Empire State Telephone and Telegraph Co., Dues for 1887		50 00
Nov.	22— " C. B. Hotchkiss, Initiation Fee and Dues for 1887		60 00
"	22— " American Electrical Works, Initiation Fee and Dues for 1887		60 00
"	22— " New York and Pennsylvania Telephone and Telegraph Co., Dues for 1887		50 00
Dec.	20— " American Bell Telephone Co., 2 copies 8th Meeting		2 10
"	20— " American Telephone and Telegraph Co., 4 copies 8th Meeting		4 00
"	20— " J. A. Roebling's Son's Co., Dues for 1887		50 00
1887.			
Jan.	12— " New York and New Jersey Telephone Co., 6 copies 8th Meeting		6 00
"	21— " Western Electric Co., 6 copies 8th Meeting		6 30
"	21— " C. N. Fay, 6 copies 8th Meeting		6 30
Feb.	21— " Bell Telephone Co. of Buffalo, 6 copies 8th Meeting		6 00
	Carried forward		$1,774 05

	Brought forward					$1,346 90
April	4—By American Press Information Bureau	Voucher No.	139			7 15
"	13— " C. H. Barney	" pt. "	143			50 00
"	28— " " "	" pt. "	143			50 00
May	4— " American Press Information Bureau	" "	144			6 90
"	6— " C. H. Barney	" "	141			14 59
"	6— " Jersey City Printing Co.	" "	134			11 05
"	6— " " "	" "	137			12 50
"	20— " C. H. Barney	" pt. "	147			50 00
June	1— " " "	" pt. "	147			50 00
"	13— " Brooklyn Daily Eagle	" "	132			3 50
"	13— " Jersey City Printing Co.	" "	142			7 80
"	13— " C. H. Barney	" "	145			12 20
"	13— " Jersey City Printing Co.	" "	146			9 75
"	13— " American Press Information Bureau	" "	148			5 70
July	16— " C. H. Barney	" "	151			100 00
"	16— " " "	" "	149			12 40
"	16— " American Press Information Bureau	" "	152			3 75
Aug.	2— " C. H. Barney	" "	155			100 00
"	5— " " "	" "	153			12 70
"	5— " American Press Information Bureau	" "	156			4 00
"	26— " Jersey City Printing Co.	" "	150			6 90
	Carried forward					$1,877 79

	Brought forward		$1,774 05
July	14— To Western Electric Co., 2 copies 8th Meeting.		2 25
"	26— " Wisconsin Telephone Co., Dues for 1887		50 10
"	26— " Central New York Telephone and Telegraph Co., Dues for 1887		50 00
Aug.	3— " Southern New England Telephone and Telegraph Co., Dues for 1887		50 00
"	29— " Southern Massachusetts Telephone Co., Dues for 1887		50 00
"	29— " Colorado Telephone Co., Dues for 1887		50 00
"	29— " Bell Telephone Co., of Canada, 10 copies of Meetings		10 23
"	29— " Southern Bell Telephone and Telegraph Co., 6 copies of Meetings		6 50
"	29— " Metropolitan Telephone and Telegraph Co., 3 copies of Meetings		3 00
"	29— " G. Buckley, London, 3 copies of Meetings		3 44
"	29— " Wisconsin Telephone Co., 6 copies of Meetings		6 30
"	29— " Western Electric Co., 7 copies of Meetings		7 25
			$2,063 12

	Brought forward				$1,877 79
Aug.	26—By Jersey City Printing Co.	Voucher	No.	154	8 25
"	30— " C. H. Barney	"	"	159	100 00
"	30— " " "	"	"	157	11 35
"	31— " The Jersey City Printing Co.	"	"	160	26 10
"	31— " The American Press Information Bureau	"	"	158	2 30
"	31— " Balance				37 33
					$2,063 12

Examined and found correct.

W. D. SARGENT, R. M. BAILEY, } *Executive Committee.*

THE PRESIDENT—What is your pleasure with the reports of the Secretary and Treasurer? The Treasurer's Report has a slight stain upon it. It is not perhaps best to inquire how the stain got there, but we can certify that it has nothing whatever to do with the correctness of the figures involved. What is your pleasure?

MR. STORKE—I would state in regard to this matter, since it has been called to the attention of the Convention, that the stain is *not* from hair oil.

On motion, both reports were approved and ordered to be placed on file.

The Secretary then read the minutes of the meetings of the Executive Committee held during the year. They are as follows:

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 9, 1886.

The Committee met at the Southern Hotel, St. Louis, at 1 P. M. Present: President Fay, Messrs. Bailey, Sargent and Keller.

It was voted that the salary of the Secretary be fixed at $1,200 for the ensuing year.

Also, voted that the Secretary be allowed his actual traveling expenses while attending the annual meetings of this Association, or when travelling on Association business under direction of the President.

There being no further business, the meeting adjourned.

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 26, 1887.

The Committee met at the Monongahela House, Pittsburgh, Penn., at 9.30 A. M. Present: President Fay, Messrs. Bailey and Sargent.

The Treasurer's Report for the past year was received, examined and found correct.

The following were fixed as the hours of business for the present meetings of the Association, viz., 10 A. M. to 1 P. M., and 2.30 to 5 P. M.

It was voted to invite Dr. Allan V. Garratt, of Boston, to explain to the Association at some time during the meeting, the new system of ordering and designating wire, devised by a committee of the National Electric Light Association, of which he was Chairman.

There being no further business, the meeting adjourned.

C. H. BARNEY,
Secretary.

On motion, the minutes were accepted and ordered to be placed on file.

THE PRESIDENT—The next business is the action on the amendment to the By-Laws previously proposed. The following amendment to the By-Laws is before you for action; to substitute in Article VII., line 2, the word "October" for the present word "July." Article VII. reads: "If any member fails to pay the yearly dues or assessments within one month from the 1st day of July, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, etc." You will remember that last year we changed the time of maturity of the annual dues so that they covered until the 1st of September and were due the 1st of October. In making that change it was not noticed that the wording of Article VII. was inconsistent with it. Therefore this amendment is desirable. It is proposed now to substitute the word "October" for the word "July" in the second line of Article VII.

The amendment was adopted.

THE PRESIDENT—Are there any new amendments proposed?

There are none.

Now, gentlemen, the hour has arrived when your President, acting as the instrument of a cruel destiny, must set in motion the machinery which shall shortly cut off his honorable and, in his opinion, most useful official activities. He must leave his conspicuous position and resume his seat in your numerous but insignificant midst. He no longer can occupy that chair or throne from which, or, in which, he can say with Cicero that he sees the eyes of all of you to be turned upon himself. He cannot longer look upon you with satisfaction—on you who remind him of Euclid's definition of a circle—"A curved line, all the points of which are equally distant from a point within called the centre." No longer will some honeyed representative of illustrated journalism beg his photograph in order to show his constituents next morning how like a prize-fighter he looks, and thus amplify Shakespeare's words by proving that one touch of art (as

well as nature) " makes the whole world kin." Alas! he must step down and out, and the utterances of another—in the next printed report of your proceedings—must be credited to that oracular article of furniture, surely carved out of the talking oak—the chair. He might be pardoned on such an occasion if he grasped his last opportunity and seized the one remaining hair on the forelock of Time, tied the old fellow's wings, tipped over his hour-glass so that its sands should not run against him, and proceeded to swing his scythe so mightily that nothing should remain on the harvest field of rhetoric but endless windrows of imagination and toppling sheaves of eloquence. But on this occasion, impelled by modesty, he will merely say a few last loving words. His expectations of a year ago have not been disappointed. The business of the year has been larger in volume, I think, than that of any recent years in the history of the business. Throughout the country a steady progress has been made in the actual art of telephony; progress has been made in the direction of service, the permanent construction and maintenance of exchanges, the improvement of switching apparatus, and, I think, in the general harmony of relations with the public. It is to be hoped that the future will smile upon us as has the past. It is to be hoped that this Association will go on, as heretofore, an instrument of usefulness among us. Its membership has reached in number, perhaps, its lowest point. The tendency to consolidation of the small exchanges into great corporations co-extensive with the land has apparently ceased for a time, and the forty companies, or some such number, which now occupy the entire telephone field, and which constitute the membership of this organization, will probably not greatly diminish. I think I can see, and say, that the Association is established, therefore, on a permanent basis, and that its members will, as heretofore, for I see many who have been, as I have, at every meeting of the Association since its first at Niagara—the members of the Association will continue to come here, year after year, by their representatives and contribute to our information, our

progress, and our enjoyment. I hope that the officers now to be elected will do their share in bringing about this happy result, and most of all the President whom it is now our duty to ballot for. I do not doubt that your selection will be happy, and that he will far improve upon all his predecessors. I thank you for the honor you have twice conferred upon me, and for the courtesy with which you have always treated me in the Chair, and now announce that we will ballot fot the next President. May he suit the Association perhaps to that identical *t* which is the difference between an *ex*-President and a *next* president.

I call for nominations, gentlemen, for the office of President.

MR. STORKE—I would nominate for your successor our present excellent Vice-President, Mr. Henry Metzger, of Pittsburgh.

The nomination was seconded.

THE PRESIDENT—Gentlemen, do you hear the nomination? The order of procedure requires that we ballot. It has been customary, heretofore, for a motion to be made to authorize the Secretary to cast the ballot of the Association.

MR. TYLER—I move you that the rules be suspended, and that the Secretary be authorized to cast the ballot of the Association for Mr. Metzger.

The motion was carried.

THE PRESIDENT—Mr. Metzger is elected.

President Metzger was escorted to the chair by Mr. Fay, and addressed the meeting as follows:

Gentlemen of the Convention: I certainly feel unable to express in proper words my thanks to you for the honor which you have conferred in selecting me as the President of the Association. It is certainly an unexpected honor. I hope I shall be able to serve you as faithfully and as well as my predecessor, although I am afraid that your expectations will not be realized. I thank you again for the honor you have conferred on me.

The next order of business is the election of a Vice-President of the Association to serve during the ensuing year. Nominations are in order.

MR. ULINE—I nominate Mr. William D. Sargent.

THE PRESIDENT—I presume the usual order of proceedings will be carried out, and the Secretary will cast the vote of the Association.

MR. STORKE—I move that the rules be suspended, and that the Secretary of the Association cast the ballot for W. D. Sargent for Vice-President.

The motion was carried.

THE PRESIDENT—The Secretary has cast the ballot for Mr. William D. Sargent.

MR. SARGENT—Mr. Chairman and gentlemen: I feel very much flattered indeed by the honor which you have seen fit to confer upon me, without even allowing a protest. I presume that you fully appreciate the evil that will fall upon you, should I accidentally be called upon to preside over your deliberations, but I shall endeavor to do the best that I can, and I feel very grateful indeed for the honor which you have seen fit to confer.

THE PRESIDENT—The next officer to be balloted for is the Treasurer. Nominations are in order.

MR. FAY—Mr. President, the present excellent Treasurer has been incautious enough to intimate that he has an arrangement with a bank president by which the bank stands behind the Association. I do not think, therefore, that we can do better than to renominate him and continue him in office—at the same salary,—Mr. Tyler suggests.

On motion, the Secretary was instructed to cast a ballot for Mr. Storke for the office of Treasurer.

THE PRESIDENT—The Secretary has cast his vote for H. L. Storke, our present worthy Treasurer.

You have to elect, as I am advised by the Secretary, one member of the Advisory Committee in the place of W. A. Jackson, of Detroit, Michigan, whose term has expired. Are there any nominations for that position?

MR. SEELY—I nominate Mr. E. J. Hall, Jr., of New York.

MR. LOCKWOOD—I suggest that the names of those who hold over for next year be read for the benefit of the Association.

THE PRESIDENT—The names of those holding over are H. N. Gifford, Louisville, Ky., and Morris F. Tyler, New Haven, Conn.

MR. LOCKWOOD—I second the nomination of Mr. Hall.

On motion, the Secretary was authorized to cast the ballot of the Association for Mr. E. J. Hall, Jr., which he did, and Mr. Hall was declared to be elected a member of the Advisory Committee.

THE PRESIDENT—We have to elect four members of the Executive Committee. The present Executive Committee are the President, who is the *ex-officio* member of the Committee; R. M. Bailey, Williamsport, Pa.; W. D. Sargent, Brooklyn, N. Y.; George N. Stone, Cincinnati, O., and J. N. Keller, Boston, Mass. Are there any nominations?

MR. FAY—I understand that two members of the Committee are ineligible for re-election. Mr. Keller is out of the telephone field, and Mr. Sargent is also out of the field for the present. That leaves two members eligible for re-election.

MR. STORKE—I nominate Mr. R. M. Bailey for his own successor.

MR. GIFFORD—I nominate Mr. George N. Stone.

MR. FAY—I nominate Mr. H. N. Gifford.

MR. GIFFORD—I am now a member of the Advisory Committee.

MR. BAILEY—I nominate Mr. J. W. Bennett.

MR. GIFFORD—I nominate Mr. Fay. He did very well as President.

MR. FAY—I beg to decline, Mr. Gifford; not that I am insensible of the honor, but I have been there.

MR. GIFFORD—I nominate Mr. S. M. Bryan, of the Chesapeake and Potomac Telephone Company. I want to nominate somebody.

On motion, the Secretary was authorized to cast the vote of the Association for the gentlemen nominated as members of the Executive Committee.

THE PRESIDENT—The Secretary has cast his vote for Mr. R. M. Bailey, Mr. George N. Stone, Mr. J. W. Bennett and Mr. S. M. Bryan.

Is there any other business to be brought before the Convention, before our regular proceedings commence ?

MR. TYLER—It is the fortune of bodies like this, assembling year by year, to be obliged now and then to render testimony to those who meet them no longer. It has been the fortune of this Association once before to commemorate its respect for a member who was dropped by the wayside, and it comes around again. This time we miss from among us one who was always welcome and whom we were all glad to see. You all know that I refer to the very sad death of Mr. Boyd, the special agent of the American Bell Telephone Company. I am confident that when the news spread through the telephone fraternity that Mr. Boyd was one of the victims of the terrible disaster at the Hotel Richmond in Buffalo, every man who had met him here felt as though he had lost a personal friend. Though my personal acquaintance with Mr. Boyd was not very intimate, still it was sufficient to make me feel, that when here, at these meetings, I should always miss a man whom I was ever glad to see, because of his traits of character, because of the help which he could be to me in the administration of the business in which we are all concerned, because a delightful companion, though his companionship had been but short, has gone for ever. I take great pleasure in expressing my very high esteem and affectionate regard for Mr. Boyd individually, and I think it due to his memory that this Association put upon its record some minute of its appreciation of him, and I beg to submit to you, Mr. President, for the consideration of this Association, the following :

The National Telephone Exchange Association at its Ninth Convention desires to express its sense of the misfortune which has befallen the telephone fraternity in the death of Mr. R. S. Boyd. Mr. Boyd, by his sweet and genial temper, his hearty good nature and his refined and attractive manners endeared himself to us all in the performance of a delicate task in which he put his tact and skill, his industry and unquestioned integrity at the service of his employers. In his death we deplore the loss of an honored and helpful

member of this Association and of a cherished personal friend, and as a token of the esteem in which his memory is held, the Association orders that this minute be spread in full upon its records and printed in its published proceedings.

THE PRESIDENT—Gentlemen, you have heard the very able remarks made by Mr. Tyler on the sudden death of Mr. Boyd, and I can but add my regrets at his untimely end. I knew him well. I knew him as a genial gentleman and one with whom my business intercourse was of a pleasant and agreeable character. I think that all of us who knew Mr. Boyd can truthfully pay this tribute to his memory.

Mr. EASTABROOK—I desire to second the resolution offered by our former President, Mr. Tyler, having been intimately acquainted with Mr. Boyd, and I desire to pay my personal tribute to his memory, as a welcome friend in my family circle, as a member of the Board of Directors of our Company. I desire to say, that in all my telephone relations I have met no one who has found a warmer place in my heart, and I believe that that is the experience of every one who was brought into intimate relations with him, and I desire to second the resolution offered by Mr. Tyler.

MR. HOVEY—I would like to move that a copy of the resolutions be sent to the widow of Mr. Boyd by the Secretary. I know as a matter of fact that the action of this Convention would be very pleasing indeed to her. It so happens that Mr. Doolittle and myself were deputed to go and attend the body of Mr. Boyd, and we naturally had some communication with the family, and we know perfectly well that every attention and every kindness that has been shown by his associates has touched them very deeply.

MR. STORKE—I would like to add my tribute to those which have already been offered to the personal qualities of Mr. Boyd. He represented, in our Board of Directors, the American Bell Telephone Company and discharged those duties faithfully, and in all his relations to the business, his tact, his good judgment and his courtesy were always appreciated by us, and his knowledge of the business and his experience in it were always helpful and were always at

our service. His death came to us all in its terrible suddenness, like a personal bereavement. I don't think we half appreciated him until he was gone. I am sure that none of us realized until he was taken away, how much we valued his association and his friendship.

MR. ULINE—I would suggest that when the vote is taken upon this resolution, that it be acted upon with a rising vote.

THE PRESIDENT—Gentlemen, you have heard the resolution read by Mr. Tyler and the amendment made by Mr. Hovey, that a copy of this resolution be transmitted to the widow of the deceased, and also the suggestion of Mr. Uline, of which I cheerfully approve, that the vote be taken standing. All in favor of this resolution will signify it by rising.

The resolution was unanimously adopted by a rising vote.

THE PRESIDENT—I desire to say for the information of the members of the Association, that the Central District and Printing Telegraph Company, whose representative I am, desire to extend all courtesies to the members of this Association. We hope your visit to Pittsburgh will be one of pleasure and at least of kindly recollections. We think we have many objects of interest, in our scenery and in the numerous workshops that line our river banks. It must be conceded that Pittsburgh has stood pre-eminent among her sister cities of the United States as being a great manufacturing city, but while we have borne our honors meekly in that respect, we have also had to bear the stigma of being the dirtiest city in the United States. We think that we are no longer entitled to that honor, and cheerfully yield the palm to Cincinnati, Chicago and St. Louis, in that respect. I know my friend Mr. Cherry will object to it. Probably our worthy ex-President, Mr. Fay, and also Mr. Durant, of St. Louis, may object to it ; but facts are facts. We attribute this transformation of our atmosphere to the introduction of natural gas, and in order that the members may see the application of it, we have provided for an excursion up the Monongahela River, to the Bessemer Works of Carnegie Brothers & Co., where it can be seen in full operation. I think it will prove a profitable and pleasant trip to all the

members of the Association, and you are all cordially invited to attend. However, we will send you formal invitations.

MR. FAY—There is an old proverb to the effect that there is no use in carrying coals to Newcastle, and I think Mr. Metzger has demonstrated that it is no use carrying natural gas to Pittsburgh; but, all the same, I would move, with enthusiasm, that the Association accept the kind invitation of the Central District and Printing Telegraph Company.

The motion was carried.

On motion of Mr. George L. Phillips, the meeting then adjourned until 2.30 P. M.

AFTERNOON SESSION.

The meeting was called to order at 2.30 P. M.

THE PRESIDENT—I desire to say to the members of the Convention that since dinner a dispatch has been received from Boston stating that Judge Colt, in the suit of the United States against the American Bell Company, has sustained the demurrer of the American Bell Company.

It seems that on this subject I have anticipated my friend Mr. Phillips, upon the only occasion upon which I expect to hear a speech from him. He has a telegram from Mr. J. E. Hudson, as follows:

"Court this morning filed its opinion in the case of the United States against this company in this Circuit. Our demurrer sustained. Government bill dismissed."

I am very sorry that I anticipated Mr. Phillips, because I have no doubt he would have made a very eloquent speech. The next business before the Convention is a paper on Long Distance Telephony, by E. J. Hall, Jr., of New York. The Convention will be pleased to hear from Mr. Hall.

Mr. E. J. Hall, Jr., then read the following paper:

NOTES ON LONG DISTANCE TELEPHONE WORK.

To talk between points hundreds or thousands of miles apart, as though standing face to face, is a feat, the accomplishment of which may well call for our best efforts. Apart from all commercial considerations it presents the fascination of an unsolved problem. No sooner had the Telephone Exchange been an established fact than inventors and "promoters" began to suggest all sorts of visionary schemes for long-distance telephone work.

Of the early experiments none were more successful than the trials between New York and Chicago, speech being transmitted between those points by a number of people with fair results. These trials showed that, under certain conditions, it was possible to talk for a distance of over a thousand miles. We all know, however, that commercial business could not be carried on under those conditions, as all successful tests were made when the wires were free from outside disturbances. As they were clear only on Sundays, and even then only when there were no storms or heavy earth currents, the effect of early experiments was rather to discourage work in this direction.

In Canada and in the Western States some long lines have been operated with success, the distances covered being far in excess of any practical working lines in the Eastern States. The reasons for this have been often discussed in our conventions, and I will not go into them now; it is enough to say that giving all due credit for what has been accomplished, no large business can ever be worked up on the basis of using grounded circuits, owing to the inevitable "cross-talk" between parallel wires. The first really practical success in talking over long distances was the copper metallic circuit constructed between New York and Boston, by Mr. T. B. Doolittle, for the American Bell Telephone Company in 1883. The distance was about three hundred miles, and I call it the first practical success, because it was the first long circuit that worked at all times regardless of outside electrical disturbances.

Early in 1885 I was appointed by that company to take charge of the development of this branch of telephone service, and the American Telephone & Telegraph Company was organized to carry on the work. At the outset it was decided that only copper wires in metallic circuits would be used, and that nothing should be spared to make the plant in every respect as perfect as we knew how to build. A builder whose work is known to you all (Mr. W. H. Fairbank) was appointed General Superintendent of Construction, and the first line was constructed between New York and Philadelphia. The specifications for this line required the use of poles not less than seven inches in diameter at the top and from forty-five feet upward in length; to be set six feet in the ground on straight lines, and seven feet on corners or sharp curves. The poles had gains for seven ten-pin arms, and three arms were at once put on, carrying twenty-four copper wires. In addition to the copper wires, one No. 8 iron wire was strung on a top pin to strengthen the line (especially during construction). The utmost pains were taken in guying and bracing, and the good results of this care in building have been fully demonstrated by the nominal expense of maintaining the line since it was finished.

There are nearly three miles of submarine cables in this line, and all crossings are made with four seven-conductor Kerite cables. In three of these cables the conductors are each composed of three No. 18½ B. W. G. copper wires twisted together and insulated to $\frac{8}{32}$ of an inch, and the cables are armored with 18 No. 4 galvanized iron wires. The fourth cable has conductors of three No. 16 wires twisted together and insulated to $\frac{9}{32}$ 1-8 of an inch, and is armored with 18 No. 2 galvanized iron wires. The cable houses are large, dry, and well lighted, and special care was taken to guard against lightning and against bad connections and leaks in the terminals. All underground and aerial cables are of large conductors, heavily insulated, and the general result has been a line which for nearly two years has worked with uninterrupted success. Wind, sleet, lightning and electrical storms have so far passed over it without causing more than the most trifling damage, and we have secured one of the most essential elements of any factor in commercial business—reliable service.

That this line would "talk well" no one questioned, as the distance (about one hundred miles) is far within the limit which previous experiments had shown to be entirely practicable. I will say here that we have not yet reached the limit of distance, but having worked over four hundred miles, we know it exceeds that. It is probable that the progress of electrical development will keep the possible limit up to the distance over which it will be commercially profitable to supply this service.

Since the completion of the Philadelphia line we have started lines of similar character between New York and Boston (250 miles), and New York and Albany (160 miles). The Boston line will be ready for service in a couple of months, and the Albany line by the end of this year.

Having completed our first line, we were at last in a position, not to commence business, unfortunately, but to work out patiently and thoroughly the problem of making these lines serviceable. Many of you will remember that at our Providence meeting, two years ago, we discussed the question as to whether there would be any serious cross-talk between metallic circuits when we had a large number of them working on the same line of poles. Opinions then varied, but the Philadelphia line showed at once that the interference between metallic circuits was practically about as bad as between grounded circuits. We determined not to offer an imperfect service to the public, and months of hard work resulted in perfecting a simple and practical method of absolutely removing all trouble from this cause. Meantime, the matter of providing suitable apparatus and methods for working metallic circuits quickly and reliably with each other and with grounded circuits at the terminal stations, was receiving constant attention, and we now are able to do this work satisfactorily, although this part of our service will always be one in which we may expect continued improvement.

As an illustration of the difficulties encountered, the repeating coil, which gave excellent results when used between New York and Philadelphia, was a complete failure when used between New York and New Haven, and a long course of investigation and experiment was necessary before we discovered the cause and provided a remedy. We have completely reversed the old idea that "Anything is good enough for a telephone line;" now I would say, "Nothing

is good enough;" but a friend suggests that, strictly construed, my statement makes the matter worse. At any rate, the best is not too good, and I am confident that the future experience of us all will convince us, if we still doubt, that the best is emphatically the cheapest in the long run.

The telephone business has now been established long enough to bring us fully into the reconstruction period—the haste of early construction is over and the problems of underground construction in our larger cities, the general use of cables in all exchanges, the necessity of providing improved switching facilities for the masses of wires which centre in our large offices, and the complicated work of providing quick and certain means of communication between our scattered exchanges are matters which call for the expenditure of lots of brain force and money before the "second construction" gives us a perfected system.

When we look over the history of the development of the telegraph and see the slow and painful progress made by the pioneers of that enterprise, it may well be a matter of surprise and congratulation that the telephone has so quickly found a profitable place in the business world. To a great extent that place had been prepared by the changes in business methods wrought by the railroad and telegraph. The use of local private telegraph lines (and especially the District Telegraph service), was of especial value to us in preparing the way by educating people in using electrical appliances for securing quick local communications.

Undoubtedly the use of the telephone has made far easier the work of introducing the electric light. This process of education is going on at a rapid rate, and the use of private leased wires between distant cities which is now so common as to be almost a necessity in certain lines of business, and the extension of our "extra territorial" telephone lines is preparing the way for the long distance telephone.

I am often asked the question, "How can you expect people to use the telephone on your long lines with rates five or ten times as high as the telegraph charges." The answer is simply this: The telephone has a field of usefulness entirely separate and distinct from that occupied by the telegraph. Of course no one will pay a dollar for a telephone message when he can *accomplish the same result* by sending a telegram for ten cents; neither will he pay ten cents for sending a telegram when he can *accomplish the same result* by sending a postal card for one cent. If the long distance telephone competes with anything it is with the railroad, and it does that in the same way and about to the same extent that the local telephone competes with livery stables and street cars.

As a matter of fact the service offered by the telephone is something which is entirely new, and when people learn its uses its place will be just as securely fixed as a most important factor in the transaction of business between distant points, as it now is in local service, and the railroads and the telegraph companies will not suffer any more than the livery stables and street cars do now from the Telephone Exchange. When people ship freight for which they are in no hurry, they send it by a sailing vesssel or by rail as ordinary freight; when time is of some importance it goes by steamer or by a fast freight line; when the goods are perishable or time is important, shippers send by express or by special messenger.

So, when in communications time is not important, people write letters; when greater haste is necessary they send telegrams, but when time presses, and there is urgent need for haste, they telephone.

When the nature of the business requires personal communication, question and answer, the railroad or the telephone line must be used, and this is our field—quick communication with instantaneous replies and prolonged personal interviews. I might give scores of illustrations, but two will suffice: A New York lawyer recently called up by telephone a lawyer in a city nearly a hundred miles away, engaged him for an important case, dictated a lot of legal papers, and inside of an hour was able to file attachments securing for his clients their interest in a large amount of property which would otherwise have been lost. This illustrates one class of service; the other is the case of the Pennsylvania railroad which has ample telegraphic facilities between New York and Philadelphia, but in addition, leases a private telephone circuit, so that the officers of the road can, without the intervention of operators and the delay of writing messages, carry on conversations between the two cities.

The contracts for service which we are daily making, and the emphatic commendation of business men who are using our lines, proved beyond question that the long-distance telephone is wanted and that good service will be paid for at rates which will make it profitable to supply the demand. It is just as certain that there is no demand for, and no profit in attempting to furnish "poor service," either in trunk lines or exchanges. Just what constitutes "poor service" is a question upon which we may not all agree. I think Mr. Jacques defined good commercial service well in a discussion of this question recently, when he said in substance that he considered a good commercial line to be one over which non-experts could converse about subjects with which they were not both familiar, without repetitions. Judged by this standard, how many exchange and toll lines would stand the test?

THE PRESIDENT—Gentlemen, you have heard the paper read by Mr. Hall. What is your pleasure?

On motion, it was ordered that the paper be printed as part of the proceedings of this Convention.

MR. BENNETT—I wish to offer a motion that the President and Secretary of this meeting send to John E. Hudson, General Manager of the American Bell Telephone Company, the congratulations of this Convention on the successful termination of the Government Pan-Electric suit.

THE PRESIDENT—Mr. Bennett, of Massachusetts, makes a motion that the President and Secretary be instructed to send a telegram to John E. Hudson, General Manager of the American Bell Telephone Company, congratulating that Company on its success in defeating the Government Pan-

Electric suit. I think that is a true statement of the case, gentlemen.

MR. DURANT—I think that should be reversed. It is the Pan-Electric Government suit.

The motion was carried.*

MR. TYLER—I make the suggestion that either the President or Secretary see that this despatch is sent, for I have in mind a congratulatory despatch sent in the early days of this convention to Mr. Bell or somebody, which was not received. It turned out that the messenger had kept it until he could send it as a night despatch, and divided with himself the difference in the fee. Our second congratulatory despatch may have the same fate.

MR. PHILLIPS—That can all be obviated by sending this message collect.

MR. TYLER—Seeing to whom the message is sent I rather approve of Mr. Phillips' suggestion.

THE PRESIDENT—Does any gentleman desire to discuss this question of Long Distance Telephony?

MR. DURANT—I would like to ask Mr. Hall to what extent the so-called long-distance transmitter is used in supplying customers with this long distance service?

MR. HALL, JR.—It is used altogether on our line.

MR. BAILEY—I would like to ask Mr. Hall how many poles to the mile are used on the line between New York and Philadelphia.

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*NOTE.—The following dispatch was sent:

PITTSBURGH, PENN., September 26, 1887.

To John E. Hudson,

General Manager, American Bell Telephone Co., Boston, Mass.

The National Telephone Exchange Association, in meeting assembled, sends congratulations on the defeat of the Pan-Electric combination.

HENRY METZGER, *President*
C. H. BARNEY, *Secretary.*

The following reply was received:

BOSTON, MASS., September 27, 1887.

To Henry Metzger.

President, National Telephone Exchange Association, Pittsburgh, Penn. Accept thanks for congratulations.

JOHN E. HUDSON.

MR. HALL, JR.—About forty poles to the mile is the average.

MR. BAILEY—Is there any great trouble with sleet storms through that country?

MR. HALL, JR.—We have had two quite heavy sleet storms since the line was finished. The copper wire stood all right.

MR. GIFFORD—I would like to ask Mr. Hall what changes are necessary, and if they are very great, in adapting our ground lines or ordinary exchange lines so as to connect with this metallic circuit?

MR. HALL, JR.—The connection between the metallic circuit and the ground line is made through a repeating coil.

MR. GIFFORD—Can repeating coils be attached to the switch-board commonly in use—the multiple—and can you use the same switch-board and appliances, and are the necessary changes easily made?

MR. HALL, JR.—Yes; very easily made.

MR. BAILEY—Are repeating coils equally practicable at each end of the line?

MR. HALL, JR.—When the repeating coil is at one end of the line, the service is very much better than when the repeating coil is used at both ends. The introduction of a second coil seems to bring in quite a serious loss. At the same time, between New York and Philadelphia, where we have good terminal lines and the instruments are in good order, there is no difficulty in carrying on, between exchange subscribers in both cities, a good business conversation. But if there is any trouble at all in the terminal line, then there is difficulty. The repeating coil seems to reduce the efficiency so far that there is no margin to spare. I am speaking of using the ordinary Blake transmitter at both ends, connected through the ordinary switch-board at both ends.

MR. FAY—Suppose it failed at one point—at New Haven, for instance?

MR. HALL, JR.—Well, the explanation of the failure of the repeating coil which worked on the Philadelphia line and did not work on the New Haven line, is this—I do not know

whether it is absolutely correct or not, but it is the conclusion which we reached. The line between New York and Philadelphia is built largely through a low, wet country. There is a great deal of marsh land, and the line is much freer from earth currents and disturbance than the New Haven line, which is built over a rocky, hilly country, and which has either a greater number or greater intensity of earth currents, or else does not have sufficient ground to relieve the line. The effect of that was, that when we put on a coil with a high static capacity, the earth currents of the metallic circuit were all carried into the grounded line, and by putting in a repeating coil with a small amount of static capacity the trouble was obviated.

MR. LOCKWOOD—I would like to corroborate or add my mite of opinion to what Mr. Hall has said with regard to upsetting the old notion that any kind of a line will do for a telephone. A good many of us can remember the time when the story used to be told, in these meetings, that a steel wire of almost any degree of smallness would stand just as well for telephone lines, and would be just as serviceable in the matter of transmission as the best line that could be built, and a great many steel lines of very small gauge were put up and used. I am not disposed to deny that the use of small wires did enable the "line fiend" to get into a great many places, and I think for that reason, very possibly, suburban work was materially advanced. A little later, some of us well remember, the theory was broached that insulation was superfluous in telephony. One gentleman went so far as to advocate putting up a long line, thirty, forty and fifty miles long without any insulators whatsoever. A great many did not go so far as that, but they put up the porcelain knobs, of which I may have a word or two to say in a special paper. Porcelain knobs are still used to some extent, and they have a function where they are protected from the weather and where the line wire is covered, but they are certainly not of any use where the line wire is bare, and exposed to the weather. Instead of relying upon the fact that the telephone works as well as it does under adverse conditions.

over bad lines, over leaky lines, over lines with bad joints in them—instead of taking for our text the story that the telephone will work over any kind of surface, we have reached the point where we must assume that the telephone current is a small thing at the best. Again and again we have heard that the current generated by the telephone is not much more than the one-millionth part of the current of a Daniell cell, and we have got to start from that point and realize that we cannot make its conditions of transmission too easy. Hereafter when we put up a subscriber's line, every one of us has got to understand that that line may be a possible link in a long line of communication between two or between three or four adjacent cities. Instead of being connected only occasionally through an exchange switch-board to another line of equal length or approximately equal length, we must regard it as one end of a very long line—perhaps two or three hundred miles long, which has a link of like character at the other end of it, and we must not forget that the two ends are the most important part of the line of communication. It does not matter how good a line we have in the middle, how good a line we have in the fifty or sixty miles which extend between the two subscribers that are talking, if the ends are bad, the working of the whole line is bad. And so, I think, that it may be emphasized, and that it cannot be emphasized too frequently, that subscribers' lines, the short exchange lines, must be well built. They must be built in just the best way we know how. The line wire must be good, the insulators must be good, the joints must be made in the best way. It does not do to put glass insulators only as far as we think a man will go to look at them. I remember a line which was recently built for a gentleman of my acquaintance and he specified particularly, because, as the lineman said, "he was a very particular man," he specified just the kind of a line he wanted, and the general manager of the telephone company unquestionably agreed with him that those conditions were highly necessary to the line, and gave the necessary orders. The line was built, and when the subscriber for whom it was built came home and

looked at it, he found that, although he had specified glass insulators, it was put up on porcelain insulators. He brought that fact to the general manager's notice, and the general manager agreed with him, as would be expected, and said that he had given orders—and I know that he did give such orders—that the line should be built just as well as it could be built. And he at once ordered that the porcelain knobs should be taken down, and the line should be insulated with glass. The lineman went and insulated that line with glass just as far as he thought the subscriber would walk back over his line, and left the knobs on the other parts.

We have got to give the best attention to the ends. I think if we have got to have a bad link in the line of communication anywhere, it is better to have it in the middle, and have the ends perfect. Ground connections must be looked after sharply. I think ground connections ought to be inspected frequently. You may put a ground connection around a gas pipe or water pipe, and it may be good when you leave it, but should the water man or the gas man in his operations have occasion to disconnect it, he does not ask whether it is a ground wire, and probably all he will do, will be to twist it around the pipe again and leave it. Very frequently he does not attempt to re-connect it. Therefore, I think that a point which should be insisted upon in exchanges, is the frequent examination of ground wires.

MR. HALL, JR.—Mr. Hibbard tells me of one little incident that occurred last week, which I think will prove interesting. In calling up for Boston over our new line, which is now completed as far as Springfield (about 175 miles from New York), the line was connected through a repeating coil on a copper wire between Springfield and Boston, about 100 miles further, so that the line as made up was 175 miles of metallic circuit, and 100 miles of ground wire, connected through a repeating coil. The 100 miles of ground circuit was very noisy. Mr. Hibbard was, for that reason, unable to make the man in Boston understand what he was saying, but he was able to understand clearly every word that the Boston man said. The Springfield man, who was in on the

ground circuit, could not hear the Boston man talking to him, and Mr. Hibbard in New York talked to the Springfield man and told him what Boston was trying to say to him. The effect of the repeating coil apparently was to screen out the noises of the grounded circuit, and while the direct current which went into the metallic circuit from the Boston transmitter was not very loud, it was perfectly clear and distinct, so that Mr. Hibbard heard without difficulty everything that was said in Boston. He says that he could have carried on a long conversation, or could have taken down a newspaper article, or anything of that kind, from dictation. But the man who was 175 miles nearer to Boston, and on the direct circuit, could not hear Boston.

MR. LOCKWOOD—Mr. Gifford asked how these induction coils were made and how they were connected. A great many of us have had practice with those coils and know that the coil is simply an ordinary induction coil differently constructed; that is, while there are two wires, each one is alternately the primary and each one is alternately the secondary; it depends on which way the transmission is going. These two wires of a resistance as nearly alike as possible, are insulated from each other and wound together upon a core. Each of the wires, of course, has two terminals or screw posts, and the two terminals of one wire are connected with the two ends of the metallic circuit, while, in the other wire, one screw post is connected with the line and the other with the ground terminal of the exchange line.

MR. SEELEY—Have you reference to the induction coil or repeating coil?

MR. LOCKWOOD—I had reference to that species of induction coil which we call a repeating coil.

MR. GIFFORD—We have all had more or less trouble with bad connections, and in the last few months I think we have had more trouble with bad connections in our Louisville exchange than in eight years previously. I find that some soldered joints are just as bad as any of those that are not soldered, probably three solder joints to one that was not soldered gave out. I would like to make inquiry in regard

to these new connectors on which Mr. McIntire, of Newark, New Jersey, I think, has a patent. Those connectors are two little tubes soldered together, and the wires are run in and then twisted. I am using them and they work very nicely, but I have used them only a few months. My opinion is that they will prove to be better than any other connections we have ever had. A good soldered connection is a good thing, but I find it is almost impossible to get a man who will go out and solder connections unless you go and stand over him with a club. If those twisting connections will answer the purpose, we will probably get our lines built better by using them. I would like to ask if any one has used those connections, and what the experience has been with them. If anybody has any information on that subject, I would be very glad to hear it.

MR. HALL, JR.—Those McIntire connections were designed originally for our long-distance lines. Before we adopted them we had a thorough test made, at the mechanical department, of the McIntire joint, the Britannia joint, soldered, and the American twist joint, soldered, the joints all being made by good linemen. Probably they were better joints than would ordinarily be made in practice, particularly as to the solder connections. The McIntire joints showed that we secured the full strength of the line wire in the joints. The other joints fell off from 15 to 25 per cent. I have forgotten, now, which was ahead, but the best showed a loss of at least 15 per cent. of the strength of the line wire; that is, the break was always at the joint, and at a pull of 15 or 20 per cent. less than would break the wire itself. Since that time we have used the McIntire joints exclusively, and they have given us entire satisfaction.

MR. LOCKWOOD—Does Mr. Gifford apply those joints to iron or copper wire?

MR. GIFFORD—I apply them to both.

MR. LOCKWOOD—I think difficulty may be experienced if they are applied to iron wire. That is, I think it possible that the conductivity may be much impaired within a few

months on account of chemical action between the two metals.

MR. GIFFORD—The holes of the tubes fit very snugly over the wires, and it makes a very tight connection, and it is better than anything else we have used.

MR. FIELD—You have not soldered joints on the iron wire?

MR. GIFFORD—No, sir.

MR. SARGENT—Don't you use iron tubes on the iron wire?

MR. GIFFORD—Yes; I use iron tubes on the iron wire, and copper tubes on the copper wire.

MR. SEELEY—It would, perhaps, be in order to state that I believe it would be advisable if all the connections of our switch-boards were made of platinum. Steel plugs rust, and brass plugs wear out very rapidly. Platinum plugs can be made very cheaply, and I think would help the service very much.

MR. BAILEY—I think we have all got the theory of how a good line should be built, whether we practice it or not. But our experience is that nearly all the troubles that we have in the telephone business are due to bad connections in the apparatus, and the most of it, with us, is the bad connections we get in the gravity switches on the subscribers' call bells. Those connections corrode either by the action of the weather or by the action of the current. It is not possible to keep them clean. Men are sent to clean them off, and they are liable to take a piece of emery paper, and make the matter worse, by rubbing off the plating which may be on them, so that they corrode very much quicker. In the last year we have been fitting up a lot of bells with a small switch of our own manufacture, in which we adopted platinum points and platinum plates. We have fitted up between 200 and 300 bells. I have not found the first one to fail us yet. I think if the use of platinum was carried all the way through in switchbord connections and bell connections it would save a vast deal of money in inspection and give a vast deal of comfort and satisfaction in service.

If manufacturers could be induced to use platinum connections I should think the additional expense would be very little. The amount of platinum used is very little, and the gross additional expense would be so slight that I think they would scarcely feel it. I have a sample of the little switches that we use, in my satchel, and I will show it to any of you who want to see it. This switch has a very small movement and they are very easily applied.

THE PRESIDENT—I hope our friends, the Western Electric and Standard Companies and others who make apparatus for telephone exchanges, will bear in mind this conversation, because I think that the suggestions made by Mr. Seeley and Mr. Bailey are very proper. We find precisely the same difficulty in Pittsburgh. It is likely to be found in any city where you have a large amount of smoke, soot or dirt.

A MEMBER—You do not have that now.

THE PRESIDENT—Well, we have had it. Is there any further discussion on this subject?

The next matter before the Association is the report of the Secretary on Exchange Statistics for the year.

THE SECRETARY—A statistical report is something that takes considerable labor to prepare, and is supposed to be very valuable for study and reference, but is rather tedious to listen to, and I shall endeavor to make the reading of it as brief as possible, omitting to read all of the tables, because they will be printed and you can read them at leisure. I say this so that the room may not be entirely vacated, because the reading of this report is to be followed by a paper that we suppose, from our knowledge of the author, Mr. Lockwood, will be very interesting.

The Secretary then read the following report on statistics:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office,
NEW YORK CITY, September 24, 1887.

MR. PRESIDENT AND GENTLEMEN—In accordance with the provisions of the By-Laws which define the duties of my office, I have the honor to present the report upon "Exchange Statistics" for the year.

On the 12th of July last, I addressed the following circular to all the companies composing the membership of the Association, viz:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office, No. 32 Nassau Street,
NEW YORK, July 9, 1887.

CIRCULAR:

The work of preparing for the Annual Meeting of this Association the Report formerly furnished by the Committee on Exchange Statistics, now devolves upon the Secretary. This report, covering, as it does, the important features in the operation of every exchange, has become more valuable each year for the purpose of comparison, and will farther increase in value and interest if the full co-operation of the several exchanges can be obtained in this work.

It is requested that the blanks opposite the questions, to be found on the inside pages of this circular, be filled up, and the report returned to this office by the 26th inst., in order to give sufficient time for work of compiling statistics. For the sake of uniformity it is suggested that the information as to number of daily connections, etc., be procured on the 20th, 21st, and 22d of this month. The information regarding the time consumed in making "ten consecutive connections" will not be called for this year, and the questions regarding the same are omitted.

The circumstances surrounding the operation of small exchanges differ so greatly as to afford no common basis of comparison, which is the object to be obtained, therefore no reports need be made from exchanges having less than 500 subscribers.

Any additional blanks required or explanation of the question asked will be cheerfully furnished.

C. H. BARNEY,

Secretary.

In accordance with this request, reports have been received from thirty-seven exchanges, representing 56,131 subscribers; these reports have been made from 22 companies, 6 companies have no exchanges as large as 500 subscribers, and 7 have failed to report. It is to be regretted that any companies neglected to respond to the request for information, which would have cost them very little trouble to have furnished, and which would have been of interest and possibly of value, to their fellow members of the Association.

The first returns were received on the 26th day of July, from the New England Telephone and Telegraph Co. (Springfield exchange), followed by those from the Central Pennsylvania Telephone and Supply Co., on the afternoon of the same day. The last returns were only received this morning, and were from a company not the farthest removed from the Secretary's office.

Following out the plan of last year's report, the results deduced from these returns will be presented in a series of comparative tables. The first one includes the population, the number of subscribers, the increase since last year and the present ratio of subscribers to inhabitants.

TABLE No. 1.

EXCHANGE SUBSCRIBERS.

Cities.	Population.	Subscribers, 1887.	Increase over 1886.	Present ratio, 1 to every	Subscribers, 1886.	Subscribers, 1885.	Subscribers, 1884.	Subscribers, 1883.	Subscribers, 1882.
Albany	90,903	1258	...	72	....	....	....	....	....
Atlanta	37,409	862	....	43	....	....	....	....	....
Baltimore (1885)	417,220	2105	242	198	1863	1630	1450	1220	1017
Boston	362,535	2130	283	170	1847	1696	....	....	....
Brooklyn (1887)	750,000	3297	500	227	2797	2354	1846	1601	801
Buffalo	155,000	1767	65	88	1702	1533	1420	1208	1047
Chicago.....Est. (1887)	510,373 800,000	4577	510	112	4067	3630	3246	2903	2596
Cincinnati	255,189	2900	....	88	....	....	....	....	....
Denver (1887)	60,000	840	61	71	779	751	723	680	620
Detroit (1887)	239,265	2585	300	93	2285	1956	1700	1474	....
East Saginaw	43,140	563	46	77	517	....	....	....	....
Grand Rapids	32,000	872	114	37	758	....	....	....	....
Hartford	42,551	824	....	51	....	....	....	....	....
Jersey City	152,093	769	76	198	693	648	391	346	....
Louisville	155,917	1661	225	94	1436	1271	....	....	....
Lowell	62,000	638	51	97	587	800	....	....	....
Milwaukee (1887)	187,802	1732	216	108	1516	1375	1163	960	....
Minneapolis (1885)	129,200	1387	....	93	....	....	....	....	....
Newark (1885)	152,985	732	....	209	....	....	....	....	....
New Haven	75,000	1227	....	61	....	....	....	....	....
New Orleans	216,140	1148	39	188	1100	1162	....	....	....
New York	1,206,299	6881	838	175	6043	5252	4808	4158	3451
Paterson	61,811	642	2	96	640	651	551	473	....
Philadelphia	847,170	2420	....	350	....	....	....	....	....
Pittsburgh	249,379	2286	335	109	1951	1688	....	....	....
Portland	33,810	735	2	46	733	....	....	....	....
Providence*	120,000	2417	Loss 751	50	3168	2802	1892	1745	....
Reading (Est. 1887)	59,163	503	Loss 60	118	563	557	....	....	....
Richmond	63,597	593	87	107	506	427	354	347	....
Saint Paul (1885)	111,000	1025	....	108	....	....	....	....	....
Scranton	43,850	617	44	71	573	....	....	....	....
Springfield	33,340	565	30	59	535	....	....	....	....
Washington	159,871	1362	90	117	1272	1138	872	....	....
Wilkesbarre	25,000	527	64	47	463	....	....	....	....
Williamsport	23,000	466	29	49	437	....	....	....	....
Wilmington	50,000	500	60	100	440	....	....	....	....
Worcester (1885)	68,389	718	73	95	645	777	....	....	....

Twenty-eight exchanges in the above list, reporting last year and this had in 1886 39,925 subscribers. This year they report 43,496, a net gain of 3,571, or about nine per cent.

New York made the greatest gain in numbers, 831, and this gain would have been still larger, but for the fact that they stopped taking contracts several months ago, being unable to provide facilities for any more subscribers. Chicago

* In 1886 Providence included in its report Pawtucket, Woonsocket, Bristol, Warren, Attleboro' and North Attleboro', which are omitted this year;—hence the apparent loss in subscribers.

shows a gain of 510, and Brooklyn of 500. The latter exchange shows the greatest percentage of increase, the number of subscribers in 1887 being nearly 18 per cent. greater than last year.

In the ratio of telephones to inhabitants, Grand Rapids, Mich., leads with 1 to every 37 of her people. Atlanta comes next with 1 to 43. which is even a better showing, when it is considered that nearly half the population of that city are blacks, and of a class from which telephone subscribers are rarely recruited. Portland, Me., has 1 to every 46. Wilkesbarre, Pa., 1 to every 47, Williamsport, Pa., 1 to every 49, Providence 1 to every 50, and Hartford 1 to every 51 of the inhabitants. These telephonic fields are evidently thoroughly developed. On the other hand, Philadelphia has only 1 telephone station to every 350 inhabitants, and Brooklyn, notwithstanding its rapid telephonic growth, shows a ratio of only 1 in every 227.

The next table exhibits the average number of daily connections. The business of thirty-seven offices is given, and that of twenty compared with last year.

TABLE NO. 2.

DAILY CONNECTIONS.

Exchanges.	1887	1886	1885	1884	1883	1882	1881
Albany	6,080						
Atlanta	8,517						
Baltimore	19,275	12,500	10,481				
Boston	17,345	12,043	10,385		4,741		
Brooklyn	17,505	14,675	10,809	5,508	5,290		
Buffalo	7,060	6,485	5,980	5,480	22,000	3,842	2,304
Chicago	44,292	32,996	31,368	27 101		16,044	16,136
Cincinnati	45,000				4,179		
Denver	5,230	4,528	4,467	5,298		3,450	
Detroit	33,146	31,723	20,800				
East Saginaw	7,330						
Grand Rapids	6,800						
Hartford	3,692						
Jersey City	4,220	4,000					
Louisville	13,200	12,000					
Lowell	2,640	2,265					
Milwaukee	6,548	6,031	4,461				
Minneapolis	16,000						
Newark	2,705						
New Haven	6,253						
New Orleans	8,002	7,381	6,791				
New York	84,750	42,003	36,153	25,912	25,891	19,727	
Paterson	2,383	2,800					
Philadelphia	17,098						
Pittsburgh	18,492	14,435	11,583				
Portland	3,354						
Providence	12,140	14,423	12,046				
Reading	2,239	2,500					
Richmond	7,651	4,307	4,072	3,013			
St. Paul	9,000						
Scranton	3,238						
Springfield	2,471						
Washington	6,219	6,705	3,939	2,782			
Wilkesbarre	3,274						
Williamsport	2,600						
Wilmington	4,756						
Worcester	2,450	2,450					

Taking the twenty exchanges which reported last year and this, it will be seen that the daily connections have increased from 236,250; in 1886 to 314,790, the present year, an increase of 78,540, or a little over 33 per cent. This is a greater proportionate increase than from 1885 to 1886, which was about 20 per cent.

Some of the larger cities show a remarkable increase; the most notable instance being in New York, which has gained 831, or nearly 14 per cent. in subscribers, but has more than doubled the number of connections, increasing from 42,003 in 1886 to 84,750 in 1887. Chicago, with a gain of 510 or 12½ per cent. in subscribers, has increased its daily connections from 32,996 to 44,292, an increase of 34 per cent.

On the contrary, Washington shows a falling off in the number of connections, from 6,705 to 6,219, although it has gained 90 subscribers during the year.

Table No. 3 shows the average daily calls per subscriber, the daily use of the telephone by each being of course double the number of calls as given in the table.

TABLE NO. 3.

CALLS PER SUBSCRIBER.

Exchanges.	1887.	1886.	1885.	1884.
Albany	4.8	.....	.....	.....
Atlanta	9.8	.....	.....	.....
Baltimore	9.1	6.7	7.	6.8
Boston	8.1	6.5	6.	.....
Brooklyn	5.3	5.2	4.5	3.6
Buffalo	3.9	3.8	3.9	4.3
Chicago	9.6	8.1	8.6	3.4
Cincinnati	15.5	.....	.....	.....
Denver	6.2	5.8	6.	7.3
Detroit	12.8	13.8	10.6	.....
East Saginaw	13.	.....	.....	.....
Grand Rapids	7.8	.....	.....	.....
Hartford	4.5	.....	.....	.....
Jersey City	5.4	5.7	.....	.....
Louisville	7.9	8.3	.....	.....
Lowell	4.1	3.8	.....	.....
Milwaukee	3.7	3.9	3.2	.....
Minneapolis	11.5	.....	.....	.....
Newark	3.6	.....	.....	.....
New Haven	5.	.....	.....	.....
New Orleans	6.9	6.6	5.9	.....
New York	12.3	6.5	7.	5.1
Paterson	3.7	4.3	.....	.....
Philadelphia	7.1	.....	.....	.....
Pittsburgh	8.1	7.3	6.8	.....
Portland	4.5	.....	.....	.....
Providence	5.	4.5	5.2	5.
Reading	4.4	4.4	.....	.....
Richmond	12.9	8.5	9.5	8.8
Saint Paul	8.7	.....	.....	.....
Scranton	5.2	.....	.....	.....
Springfield	4.3	.....	.....	.....
Washington	4.5	5.2	3.5	.....
Wilkesbarre	6.2	.....	.....	.....
Williamsport	5.5	.....	.....	.....
Wilmington	9.5	.....	.....	.....
Worcester	3.4	3.7	.....	.....

Thirty-seven exchanges have reported, of which number twenty can be compared with last year. In 1886, Detroit subscribers showed the greatest appreciation of the telephone, judging from the amount of use made of it; but this year they are surpassed by those of Cincinnati, which reports a daily average of 15.5 calls per subscriber, East Saginaw, which claims 13, and Richmond, which shows 12.9, the average of Detroit being 12.8 per subscriber. New York reports 12.3 calls daily from each station. It is evident that in all these exchanges these are the "busy wires" of which the poet writes, while on the other hand, the taciturn inhabitants of Worcester, Mass., seem to converse with their neighbors only 3.4 times per day each, on an average.

Of the twenty exchanges reporting last year and this, twelve show an increase in the number of daily calls per subscriber, seven report a decrease, and one, Reading, Penn., is exactly the same as in 1886.

Table No. 4 refers to the number of connections lost or delayed from such causes, as "busy," "don't answer" and "in trouble;" thirty-three exchanges here reported, twenty-five can be compared with 1886.

TABLE No. 4.

LOST OR DELAYED CONNECTIONS.

Exchanges.	1887.		1886.		1885.		1884.	
	No. daily.	Per cent.	No. daily.	Per cent.	No. daily.	Per cent.	No. daily.	Per cent.
Albany	465	7.6						
Atlanta	200	2.3						
Baltimore	1,224	6.3	900	7.2	900	9.	800	8.
Boston			1,021	8.5	618	5.		
Brooklyn	1,363	7.8	817	5.6	506	5.	634	11.
Buffalo	527	7.5	421	6.5	446	7.	520	9.
Chicago	4,326	9.8	3,852	17.	2,759	8.7	1,355	5.
Cincinnati	500	1.1						
Denver	208	4.	186	4.1		6.		
Detroit	3,209	9.7	2,100	6.6	2,120	10.		
East Saginaw	443	6.	263					
Grand Rapids	645	9.5	617					
Hartford	100	2.7						
Jersey City	269	6.4	200	5.				
Louisville	Est'd	10.	Est'd	10.				
Lowell	75	2.8	195	8.6				
Milwaukee	994	15.2	2,052	34.	892	20.		
Minneapolis	1,600	10.						
Newark	40	1.5						
New Haven	950	15.2						
New Orleans	450	5.6	600	8.1	426	6.5		
New York	443	.5	2,180	5.5	1,959	5.	1,789	8.
Paterson	216	9.1	125	4.5				
Philadelphia								
Pittsburgh	1,735	9.4	1,397	9.7	1,085	10.		
Portland	263	7.8	238					
Providence								
Reading	268	12.0	150	.6				

LOST OR DELAYED CONNECTIONS—*Continued.*

Exchanges.	1887.		1886.		1885.		1884.	
	No. daily.	Per cent.	No. daily.	Per cent.	No. daily.	Per cent.	No. daily.	Per cent.
Richmond	.....	.....	.....	.....	.....	.....	.....	.....
Saint Paul	900	10.	.....	.....	.....	.....	.....	.....
Scranton	171	5.3	195	.....	.....	.....	.....	.....
Springfield	119	4.8	113	.....	.....	.....	.....	.....
Washington	576	9.3	738	11.	777	1.9	602	20.
Wilkesbarre	175	5.3	62	.....	.....	.....	.....	.....
Williamsport	250	9.6	158	.....	.....	.....	.....	.....
Wilmington	234	4.9	.....	.....	.....	.....	.....	.....
Worcester	175	7.1	125	5.1	.....	.....	.....	.....

Milwaukee, for the third year, reports the heaviest percentage of lost connections, which is for this year 15.2 per cent. This, however, is much smaller than last year, when 34 per cent. was reported. New Haven, which did not report for two years past, shows the same percentage as Milwaukee. New York makes the remarkable claim that its "missed calls" only amount to 2.658 *per week* out of a total of 84,750 calls per day. Counting only six days to the week, this percentage would be about *one-half of one per cent.*, which seems almost incredible; but, as some one has previously remarked, "figures won't lie," and these figures have been verified by personal inquiry at the office of the General Superintendent.

Table No. 5 gives the average number of connections made daily by each subscriber operator, from 8 A. M. to 6 P. M. Thirty-seven exchanges have reported those figures; twenty-six can be compared with last year.

TABLE NO. 5.

CONNECTIONS PER OPERATOR.

Exchanges.	1887.	1886.	1885.	1884.	1883.	1882.
Albany	429	.....	.....	.....	.....	.....
Atlanta	746	.....	.....	.....	.....	.....
Baltimore	788	595	390	.....	.....	.....
Boston	788	514	375	.....	.....	.....
Brooklyn	384	367	277	177	132	.....
Buffalo	269	233	233	221	263	148
Chicago	328	300	290	271	202	161
Cincinnati	522	.....	.....	.....	.....	.....
Denver	319	269	291	360	379	246
Detroit	942	709	710	.....	.....	.....
East Saginaw	732	643	.....	.....	.....	.....
Grand Rapids	469	372	.....	.....	.....	.....
Hartford	310	.....	.....	.....	.....	.....
Jersey City	388	400	.....	.....	.....	.....
Louisville	612	633	.....	.....	.....	.....
Lowell	440	324	.....	.....	.....	.....
Milwaukee	345	335	281	203	269	.....

CONNECTIONS PER OPERATOR.—*Continued.*

Exchanges	1887.	1886.	1885.	1884.	1883.	1882.
Minneapolis	960	.....	.....	.....	.....	.....
Newark	116	.....	.....	.....	.....	.....
New Haven	338	.....	.....	.....	.....	.....
New Orleans	1,073	1,054	848	.....	.....	.....
New York	895	200	255	145	120	114
Paterson	303	400	.....	.....	.....	.....
Philadelphia	465	.....	.....	.....	.....	.....
Pittsburgh	569	504	526	.....	.....	.....
Portland	305	327	.....	.....	.....	.....
Providence	301	280	335	.....	.....	.....
Reading	334	355	.....	.....	.....	.....
Richmond	1,028	.....	.....	.....	.....	.....
Saint Paul	304	.....	.....	.....	.....	.....
Scranton	405	620	.....	.....	.....	.....
Springfield	305	293	.....	.....	.....	.....
Washington	530	637	387	.....	.....	.....
Wilkesbarre	444	469	.....	.....	.....	.....
Williamsport	325	401	.....	.....	.....	.....
Wilmington	910	.....	.....	.....	.....	.....
Worcester	237	306	.....	.....	.....	.....

By this table it appears that the operators at New Orleans do the most work, and those at Newark, N. J., the least, the former averaging 1,073 connections daily, and the latter only 116. And, notwithstanding the apparent fact that each young lady in the Newark Exchange devotes five minutes to answering each call, and making the necessary connection, the writer is able to aver, from personal knowledge, that the subscribers in that city are not even yet as happy as they would like to be.

Eighteen exchanges, working on the multiple system, average 645 connections per day by each operator, while sixteen exchanges using straight boards average for each operator 350 daily connections.

In most exchanges the operators appear to be doing more work than last year, the reverse, however, being the case in Jersey City, Louisville, Paterson, Portland, Reading, Scranton, Washington, Wilkesbarre, Williamsport and Worcester.

Table No. 6 shows the number of wires which each subscriber operator is expected to attend.

TABLE NO. 6.

SUBSCRIBERS' WIRES PER OPERATOR.

Exchanges.	1887.	1886.	1885.	1884.	1883.
Albany	77	.....	.....	.....	.....
Atlanta	85	.....	.....	.....	.....
Baltimore	98	67	71	85	30
Boston	95	88	63	.....	.....
Brooklyn	74	72	71	68	48
Buffalo	62	57	70	67	67
Chicago	34	37	33	34	31

SUBSCRIBERS' WIRES PER OPERATOR.—*Continued.*

Exchanges.	1887.	1886.	1885.	1884.	1883.
Cincinnati	37				
Denver	52	48			
Detroit	76	71	70		
East Saginaw	38	55			
Grand Rapids	60	57			
Hartford	33				
Jersey City	58	64			
Louisville	71	70			
Lowell	42	37			
Milwaukee	76	71	91	64	46
Minneapolis	62				
Newark	46				
New Haven	73				
New Orleans	157	142	144		
New York	84	91		66	
Paterson	76	75			
Philadelphia	56				
Pittsburgh	65	62	65		
Portland	38	37			
Providence	28	35	35		
Reading	57	44			
Richmond	84	128	108	88	
Saint Paul	38				
Scranton	32	47			
Springfield	71	67			
Washington	80	79	126		
Wilkesbarre	34	53			
Williamsport	44	64			
Wilmington	90	92			
Worcester	34	34			

Eighteen "multiple" boards average 71 wires per operator; sixteen "straight" boards average 55 wires per operator. In both cases this is a reduction from last year's averages.

The cost of making connections in the several exchanges is shown by Table No. 7, which contains statistics from thirty-four exchanges.

TABLE NO. 7.

COST OF CONNECTIONS.

Exchanges.	Cost of One Connection.					
	1887.	1886.	1885.	1884.	1883.	1882.
Albany	.0026					
Atlanta	.0029					
Baltimore	.0013	.0045	.0025	.0040	.0058	.0072
Boston		.0166	.0038			
Brooklyn	.0041	.0040	.0041	.0069	.0098	
Buffalo	.0053	.0057	.0064	.0060	.0047	.0072
Chicago	.0040	.0056	.0048	.0054	.0064	.0073
Cincinnati						

COST OF CONNECTIONS.—*Continued.*

Exchanges.	Cost of One Connection.					
	1887.	1886.	1885.	1884.	1883	1882.
Denver	.0055	.0061				
Detroit	.0014	.0016	.0021			
East Saginaw	.0025	.0020				
Grand Rapids	.0024	.0052				
Hartford	.0043					
Jersey City	.0043	.0050				
Louisville	.0026	.0033				
Lowell	.0062	.0063				
Milwaukee	.0032	.0035	.0046	.0113	.0055	
Minneapolis	.0016					
Newark	.0060					
New Haven	.0066					
New Orleans	.0018	.0011	.0015			
New York	.0078	.0083	.0066	.0066		
Paterson	.0056	.0050				
Philadelphia	.0037					
Pittsburgh	.0031	.0035	.0051			
Portland	.0071	.0078				
Providence						
Reading	.0047	.0020				
Richmond	.0023					
Saint Paul	.0028					
Scranton	.0046	.0034				
Springfield	.0052	.0060				
Washington	.0037	.0031	.0051			
Wilkesbarre	.0045	.0028				
Williamsport	.0048	.0034				
Wilmington	.0020	.0026				
Worcester	.0089	.0073				

Four Pennsylvania exchanges, viz: Reading, Scranton, Wilksbarre, and Williamsport, pay considerably more (from 25 to 100 per cent.) for connections than they reported last year. The following exchanges have slightly reduced their operation expenses, viz: Baltimore, Chicago, Denver, Grand Rapids, Jersey City, Louisville, New York and Springfield. Brooklyn, Buffalo, Milwaukee and the rest of the list report almost identically the same cost as a year ago, showing the reliability of their figures, and indicating that they cannot bring their work down to a much finer point than it is at present.

Table No. 8 gives the number of trunk lines, and, as might be expected, shows that these lines are becoming more numerous each year.

TABLE NO. 8.

NUMBER OF TRUNK LINES.

Exchanges.	1887.	1886.	1885.	1884.	1883.	1882.
Albany	24					
Atlanta						
Baltimore	18	17				
Boston	213	183	152			
Brooklyn	221	175	126	104	89	

NUMBER OF TRUNK LINES.—*Continued.*

Exchange.	1887.	1886.	1885.	1884.	1883.	1882.
Buffalo	57	57	45	37	26	21
Chicago	360	366	355	254	245	228
Cincinnati	260	.....	.....	.....	.....	.....
Denver	.....	.....	.....	.....	.....	.....
Detroit	37	30	20	.....	.....	.....
East Saginaw	10	4	.....	.....	.....	.....
Grand Rapids	.....	.....	.....	.....	.....	.....
Hartford	16	.....	.....	.....	.....	.....
Jersey City	69	67	.....	.....	.....	.....
Louisville	12	2	.....	.....	.....	.....
Lowell	12	12	.....	.....	.....	.....
Milwaukee	.....	.....	.....	.....	.....	.....
Minneapolis	14	.....	.....	.....	.....	.....
Newark	23	.....	.....	.....	.....	.....
New Haven	20	.....	.....	.....	.....	.....
New Orleans	.....	.....	.....	.....	.....	.....
New York	755	600	520	491	331	274
Paterson	21	26	.....	.....	.....	.....
Philadelphia	60	.....	.....	.....	.....	.....
Pittsburgh	78	47	39	.....	.....	.....
Portland	5	6	.....	.....	.....	.....
Providence	39	32	37	42	38	48
Reading	9	5	.....	.....	.....	.....
Richmond	.....	1	.....	.....	.....	.....
Saint Paul	16	.....	.....	.....	.....	.....
Scranton	2	2	.....	.....	.....	.....
Springfield	13	12	.....	.....	.....	.....
Washington	4	5	.....	.....	.....	.....
Wilkesbarre	7	7	.....	.....	.....	.....
Williamsport	2	2	.....	.....	.....	.....
Wilmington	6	6	.....	.....	.....	.....
Worcester	12	8	.....	.....	.....	.....

Table No. 9 shows statistics regarding the daily use of trunk lines.

TABLE NO. 9.

TRUNK CONNECTIONS.

(Daily Connections per Trunk.)

Exchanges	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	18	.....	.....	.....	.....	.....	.....
Atlanta	.....	.....	.....	.....	.....	.....	.....
Baltimore	12	26	.....	.....	.....	.....	.....
Boston	.....	27	24	.....	.....	.....	.....
Brooklyn	22	25	33	22	28	.....	.....
Buffalo	26	26	36	39	50	41	21
Chicago	75	61	56	38	.....	.....	.....
Cincinnati	38	.....	.....	.....	.....	.....	.....
Denver	.....	.....	.....	.....	.....	.....	.....
Detroit	155	61	52	.....	.....	.....	.....
Grand Rapids	.....	.....	.....	.....	.....	.....	.....

TRUNK CONNECTIONS—*Continued.*

Exchanges.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Hartford	9						
Jersey City	13	13					
Louisville	40	40					
Milwaukee							
Minneapolis	15						
Newark	16						
New Haven	27						
New Orleans							
New York	43	56	48	31	41	31	23
Paterson	10	10					
Philadelphia	36						
Pittsburgh	69	74	111				
Portland	8	11					
Providence							
Reading	76	4					
Richmond							
Saint Paul	18						
Springfield	13	9					
Washington	10	8					
Wilkesbarre	25	30					
Williamsport	48	41					
Wilmington	22						
Worcester	80						

Seventeen exchanges reporting last year showed an average of 31 connections per day over each trunk line; twenty-six exchanges this year report a daily average of 39 connections. It will be noticed that in Detroit this average is greatly exceeded, that exchange making the remarkable claim of 155 daily connections over each trunk wire. These figures, however, have been verified, and must be accepted as correct.

The average also shows that the use of trunk lines is increasing year by year.

Table No. 10 exhibits the capacity of the "cord" and "plug" switchboards in use in the reporting exchanges, and indicates that the plug board is rapidly becoming obsolete. The majority of that style of boards now in use are in the New York offices, and will disappear from the next report with the removal of those offices to the new colossal multiple board in the new building on Cortlandt street.

TABLE NO. 10.

Year.	Cord.	Plug.
1887	51,627	12,215
1886	34,190	9,235
1885	46,985	15,110
1884	38,070	23,418
1883	21,432	12,763
1882	16,799	12,755
1881	8,893	11,904

The proportion of "direct" and "circuit" wires in the different exchanges is shown in Table No. 11.

TABLE NO. 11.

DIRECT AND CIRCUIT WIRES.

Exchanges.	1887.		1886.		1885.	
	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.
Albany	1,087	60	.....	.....	.....	.....
Atlanta	821	10	.....	.....	.....	.....
Baltimore	1,078	372	1,007	404	831	382
Boston	2,056	34	1,769	36	1,666	44
Brooklyn	2,705	170	2,157	195	1,734	237
Buffalo	1,258	174	1,185	183	1,102	165
Chicago	4,577	.....	4,067	.....	3,630	.....
Cincinnati	2,222	299	.....	.....	.....	.....
Denver	740	44	717	9	715	10
Detroit	2,060	231	1,821	189	1,605	156
East Saginaw	345	153	390	53	.....	.....
Grand Rapids	738	48	638	45	.....	.....
Hartford	176	193	.....	.....	.....	.....
Jersey City	442	143	385	131	350	127
Louisville	776	434	675	372	730	271
Lowell	82	173	32	227	52	221
Milwaukee	1,311	129	1,172	104	986	112
Minneapolis	579	287	.....	.....	.....	.....
Newark	697	2	.....	.....	.....	.....
New Haven	214	261	.....	.....	.....	.....
New Orleans	1,034	47	995	73	975	84
New York	6,842	8	6,004	6	5,213	6
Paterson	433	99	441	92	459	94
Philadelphia	1,897	132	.....	.....	.....	.....
Pittsburgh	1,738	210	1,457	205	1,120	173
Portland	45	316	37	329	.....	.....
Providence	322	675	340	944	324	616
Reading	104	240	145	184	147	233
Richmond	580	6	490	9	.....	.....
Saint Paul	469	210	.....	.....	.....	.....
Scranton	84	168	69	164	.....	.....
Springfield	41	162	52	145	.....	.....
Washington	478	300	444	270	292	314
Wilkesbarre	128	73	119	91	.....	.....
Williamsport	114	152	105	151	.....	.....
Wilmington	433	17	372	33	.....	.....
Worcester	57	215	78	192	88	185
Total	31,921	6,239	21,159	4,830	16,746	3,424

Twenty-eight exchanges last year reported 21,159 direct and 4,830 circuit wires, and thirty-seven exchanges reporting this year show 31,921 direct and 6,239 circuit wires. The tendency is evidently more and more toward direct wires, although the two, three and "four-party lines" retain their popularity in New England, Worcester and Springfield, both of which have gained in subscribers, having actually *less* direct wires than in 1886.

Table No. 12, salaries of operators, is gathered from a field of thirty-two exchanges, employing 1,150 operators, and shows the following results :

TABLE NO. 12.

SALARIES OF OPERATORS.

Thirty-two Exchanges—1,150 Operators.	Weekly Salary.
Highest (including Chief Operator)	$23.75
Lowest	2.50
Average	6.02

As last year, New York pays the highest average salaries, viz.: $13.13 per week, and Reading, Penn., the lowest, $3.87. The general average is $6.02 as against $6.61 last year.

The next table shows the wages paid to linemen and inspectors.

TABLE NO. 13.

SALARIES OF LINEMEN AND INSTRUMENT MEN.

Thirty-four Exchanges—248 Men.	Daily Pay of		
	Line Men.	Instrument Men.	Combination Men.
Highest	Phil. $2.75	Louisville $3.00	N. Y. $2.88
Lowest	1.50	Wilmington .77	E. Sag. 1.15
Average	2.02	1.81	2.06

This table was made up from reports embracing 34 exchanges, employing 248 men.

The highest average wages are again paid by New York ; Louisville and Washington pay the lowest wages to linemen, and Wilmington, Del., the lowest to instrument and combination men.

In conclusion, it is gratifying that the report this year has been made fuller and more valuable for comparative purposes by the larger number of exchanges reporting, and it is to be hoped that next year may show even a greater improvement in this respect. The labor required to make out the reports asked for by the Secretary is very slight to each individual manager, and the consolidated statistical report, dry and uninteresting as it may be to listen to, is, when printed, useful for reference and valuable for study at leisure in the future.

Respectfully submitted,

C. H. BARNEY,

Secretary.

THE PRESIDENT—Gentlemen, if you have no objection, the report of the Secretary will be embodied in the printed

T.

Worcester ..... (1870)	84,380	1	
Wilmington	80,000	1	
Williamsport	31,000	1	
Wilkesbarre	38,000	1	
Washington	109,199	1	
Springfield	35,000	1	
Scranton	45,850	1	
Savannah ..... (1870)	28,235	1	
Rochester	89,366	1	
Richmond	51,038	2	
Reading	33,929	1	
Providence, R.I. (1870)	100,675	1	
Paterson	33,579	1	
Pittsburgh	86,076	1	
Peoria	29,259	1	
Philadelphia	674,022	1	
Petersburg	21,000	1	
Pawtucket	19,030	1	
Oswego	21,116	1	
Omaha	16,000	1	
Oil City	10,000	1	
Norwich	21,000	1	
New Haven	50,840	1	
Newburyport	13,500	1	
Newark ..... (1870)	105,059	1	
Nashua	13,000	1	
Mobile	32,034	1	
Milwaukee ..... (1870)	71,440	1	
Memphis ..... (1870)	40,226	1	
Meriden	15,000	1	
Manchester	23,000	1	
Lowell	40,928	1	
Lockport	12,000	1	
Lexington	16,656	1	
Leavenworth	17,873	1	
Lancaster	25,769	1	
Kingston	18,000	1	
Jersey City ..... (1870)	82,546	1	
Jacksonville	10,000	1	
Indianapolis ..... (1870)	48,244	1	
Hartford	42,015	1	
Grand Rapids	21,000	1	
Galveston	13,818	1	
Fort Wayne	17,718	1	
Fall River	26,766	1	
Erie	19,646	1	
Elizabeth	20,832	1	
Dubuque	18,000	1	
Detroit ..... (1870)	79,577	1	
Dayton	30,473	1	
Davenport	20,038	1	
Cumberland	10,000	1	
Columbus	31,274	1	
Cincinnati	216,239	1	
Chicago ..... (1870)	298,977	1	
Charleston	48,956	1	
Cambridge	39,634	1	
Burlington	11,365	1	
Buffalo	117,714	1	
Boston	250,526	1	
Bridgeport	29,148	1	
Brooklyn ..... (1870)	396,099	1	
Baltimore ..... (1870)	267,354	1	
Augusta	12,493	1	
Auburn	17,225	1	
Atlanta	21,789	1	
Albany	69,422	1	

* In Branch Offices.

proceedings of the Convention. Is there any discussion? Any questions to be asked?

MR. SEELEY—I think it is no more than right to state to the gentlemen of this Convention, who seemed to be very much amused at the small number of lost connections in New York, that this system prevails there. When a man calls for a connection—if the party is not in his office—a note is made of it and we ring them up afterwards. It may, possibly, be twenty minutes after the call that the connection is made. That is the reason why we have such a small loss of connections.

THE PRESIDENT—Do your operators keep a record of all the calls they get?

MR. SEELEY—Yes, sir. If a subscriber calls for another subscriber and we cannot raise him, the operator makes a ticket, which is filed on a hook. Those tickets go to the chief operator, who is instructed to try to get those connections afterwards. If they succeed in getting those connections any time thereafter during the day, of course we do not count them as lost connections.

MR. DURANT—The connection is not lost until the day is lost. It is good till sundown.

MR. LOCKWOOD—It is a realization of the old adage—"Nothing is lost if you know where it is."

THE PRESIDENT—The next business before the Convention, gentlemen, is the paper by Mr. Lockwood on the subject of "Ten Years' Progress in Practical Telephony." Are you prepared to place the paper before the Convention, Mr. Lockwood?

MR. LOCKWOOD—Yes, sir. Before beginning to read this paper, I think a word of explanation is in order. It is not a technical paper in any sense of the word. I had not intended presenting any paper here, because I have almost reached that condition where I think any man can write a better paper than I can. But our Secretary insisted that if it was possible for me to find time, I should write a paper. I listened to his insistance and went off on a three weeks' vacation, hoping that he would forget about it. I came back

a week ago Sunday, and found a letter from him, suggesting a subject (my conditional acceptance of his invitation being on the understanding that he should suggest a subject), which is the subject before you. If I stumble, it must be laid to the various erasures which are here just as I scribbled the paper off.

Mr. Lockwood then read the following paper:

TEN YEARS OF PROGRESS IN PRACTICAL TELEPHONY.

The year 1887 marks a decade from the institution of the first experimental telephone exchange, and it seems an eminently proper time for a retrospective glance through the various and transitional conditions through which the telephone exchange system as a whole has passed on its way to the present period and degree of excellence.

ANTE-TELEPHONE EXCHANGE SYSTEMS.

It is fitting at this point that your attention should be called to the fact that the idea of electrical intercommunication is older than the electrical telephone. There is no space in this paper, and not time enough at this meeting, to recount in detail the special features of these ante-telephonic exchanges, but the paper would be incomplete without at least a glance at them. The first idea of exchange work, which to my knowledge occurs in history, is found in a British patent issued as far back as February 7th, 1851, to F. M. A. Dumont. This clearly describes an exchange system of dial telegraph instruments; connecting by short lines with branch central stations, which branch stations were provided with trunk lines connecting them with a principal station. Some of the substation lines converged directly to the main central station. M. Dumont showed two forms of switch-board; in one form the lines were connected by flexible conductors having hooks at their ends, and to unite two lines it was only necessary to bring two hooks together.

I show here a picture of the system of lines. The second form of switch-board comprised a number of dials with switches revolving on a pivot at their center, the switch representing a line to be connected with other lines, which latter was represented by metal studs arranged round the switch dials.

The idea was far ahead of the times, and I do not know whether it ever went into use.

At a later period, after the British Post Office had assimilated the telegraphs of that country, and while the telegraph was still the only means of electrical communication between place and place, the plan of intercommunication between sub-stations by means of a switch as a central station was used in England at various places. The post office used it at Colchester for the ordinary business between several small towns in that district, and between them and London; and at Newcastle between persons renting private lines; in the former case the Morse sounder was used for signaling; in the latter the Wheatstone dial was employed.

In our own country it is well known that large telegraph offices have been almost from the introduction of telegraphy, fitted with switch-boards whereby different lines could be interconnected. This was, however, in such cases merely a secondary function, and such interconnections were chiefly used for the purpose of patching defective lines, for putting several lines together longitudinally to constitute temporarily a long through line; or to arrange for some President, or General Superintendent, who at a watering-place or summer resort would, upon occasion, desire to converse telegraphically with his confidential clerk at the home office.

The very essence of the electrical exchange business is, on the contrary, the continual interconnection of the various lines. But notwithstanding this difference in function, it is quite obvious that the entire American system of telegraphy has been from the beginning a colossal aggregation of central offices for telegraphic communications, possessing switch-boards for changing and coupling circuits, electrical apparatus fot sending signals, apparatus for receiving signals, and devices for either establishing through communication between two wires, or terminating one or more circuits at the earth.

In 1869, the Gold and Stock Telegraph Company established an exchange system of printing instruments between a number of the banks and the Clearing-house of New York, which existed in different forms until the telephone made its appearance.

Immediately after the war Mr. Henry Bentley established a system of intercommunication at Philadelphia, the lines of which were classified as "Telegraph Exchange," "Financial and Commercial News," "Bank Lines," and "Private and Local" lines.

Scores of business houses and firms were so connected telegraphically at will, through a general central office, that they were enabled, whenever desirable, to transact business telegraphically directly with each other, or with the central station.

Morse keys and sounders were used in this exchange, and the connecting operator at the central station had not only to connect and disconnect the lines, but also to arrange the batteries as the length of combined line varied.

Next comes the exchange system of the Law Telegraph Company, which was organized in the Spring of 1875. It was the result of an idea of Mr. Wm. A. Childs, to whom is due the credit of working it up.

This Company operated in New York, and placed both a dial telegraph and call bell, and a Morse key and sounder at each subscriber's station. The dials and bells were on private wires conveying to a central station, and a number of the Morse instruments were in circuit together upon a call wire also extending to the same central station; much the same in a general way as is the case in the present so-called "Law" system. At the said central station was a switch-board and a set of trained operators to work the same.

The call was sent in by repeating numbers on the Morse circuit.

EARLY TELEPHONE EXCHANGE WORK.

The telephone, as we all know, was patented in 1876. It achieved its first great success at the Centennial, and the second telephone patent was issued on January 30, 1877.

That its applicability to the purpose of intercommunication was from the first appreciated, is abundantly proved by contemporary records.

I myself remember being present at a lecture given by Professor Bell at Chickering Hall, New York, in May, 1877, where, although there was a good deal of doubt in my mind about the actual existence of a real Watson at the other end; and though the major part of the exhibition feature of the lecture consisted in "waiting for Watson," I clearly gathered from the words of Mr. Bell that in his mind the telephone was to be used as the operative instrument of just such systems as we have now, and whereby houses could be enabled to connect with the butcher, the baker and the candlestick maker if desired. This impression of the lecture I have always retained with particular sharpness, by reason of the *sotto voce* remark of a zealous Englishman immediately behind me, who, upon this statement made by Professor Bell, said, with a profound disregard of the rights of the letter H, "I suppose each ouse hadded to the circuit would be about one home." He evidently meant one ohm, but as he stated it, the proposition was indisputable.

The first telephone line actually built for the purpose was finished on April 4, 1877, and extended between the office of Mr. Charles Williams, Jr., at 109 Court street, Boston, and his house at Somerville, Mass.

THE FIRST TELEPHONE EXCHANGE.

In 1877 Mr. E. T. Holmes was carrying on an electrical burglar alarm business at 342 Washington street, Boston.

He had a number of lines already in existence. Telephones were placed at the offices of a number of the subscribers to this system, and by means of a switch-board, purchased for the purpose by Mr. Holmes, the lines were up on the 17th day of May, 1887, and thereafter repeatedly placed in intercommunication, the connecting link being simply a double flexible conductor, with a central office telephone at all times in its circuit.

Calling was done in both directions by means of the burglar alarm apparatus. This was later discontinued, because the subscribers were not willing to pay for the luxury as the telephone was then considered.

The next historical telephone exchange was located in the drug store of Isaac C. Smith, at Hartford, who leased a lot of telephones from the New England Telephone Co., and constructed a series of lines from a number of doctors' offices and livery stables to his store, furnished the telephones to the said doctors and stablemen, established a home-made switch and a call bell in his store, and was in the habit of connecting the doctors' lines to one another and to the stables, as they might be called for.

This exchange was brought into some local prominence, as a railroad accident occurred one night during its existence at Tariffville, on the Connecticut Western Railroad, and the news coming to Hartford, the doctors were collected to go out on a special train by means of their telephones, upon call from Mr. Smith, much quicker than they could have been otherwise.

But Mr. Smith died and made no sign, and his embryotic exchange was merged into the Hartford exchanges.

THE COMMERCIAL TELEPHONE EXCHANGE.

The first city of the world to open a commercial telephone exchange was New Haven, Conn. This was opened to the public on January 28, 1878.

The moving spirit in it was George W. Coy. Its establishment was rapidly followed by that of a similar exchange at Meriden, by E. B. Baker, the latter being opened on February 14, 1878.

From this time onward we cannot in this paper follow the history of individual exchanges, but must be content to generalize. It suffices to say that exchanges at Lowell, Albany, Hartford, Holyoke, Springfield, Newport and New York were quickly organized, and the telephone exchange idea was successfully established.

THE ERA OF COMPETITION AND RECKLESS CONSTRUCTION.

In the year 1878 the Western Union Telegraph Company seems to have reached the conclusion that the telephone business would be profitable, and they took a hand in it, and organized exchanges with a good deal of enthusiasm in many of the cities throughout the United States, in competition with the exchanges operating under the Bell Telephone license.

Looking back we can, I think, truthfully say, that although such competition was severe for those engaged in it, it became a means for spreading the use of the telephone widely over the land, for the wide establishment of the telephone exchange, and for accustoming the public to the frequent use of the telephone, which no other agency could probably have equaled. The ultimate result was that by the end of the competition in 1880, nearly every important city and town in the United States had a telephone exchange.

But there was another result. Such a competition implied usually that the exchange which fully occupied the ground first, held a great point of vantage against the other, which need only be lost by absolute neglect; consequently there was a fierce and extensive rivalry in the construction of lines, and in making low rates, which we are still suffering from. The cry was—cover the ground; get your lines up—give us good construction if possible, but give us the lines good or bad. We know now that many of the lines built on this principle were bad.

Rates were given, upon which the lines certainly had to be operated at a loss, but the business was new and this was not seen until later. $36, $24, $22 and nothing per annum were charged. So far as I am aware, Pittsburgh and St. Louis are the only exchanges that began work at remunerative rates.

The Western Union exchanges were mostly fitted with switch-boards recommended by that Company, most of them having the board known as the Universal Jack-knife Switch. This was a flexible cord board. The lines were usually worked on the closed circuit or battery principle. Being built chiefly by old telegraphers the lines were usually well constructed of good galvanized iron wire, of sizes varying from No. 9 to No. 12, and were well insulated upon glass or rubber hooks.

The telephones comprised an almost infinite number of styles of Edison transmitter, and half a dozen styles of magneto telephone; exchanges organized by the Bell telephone interest also chiefly adopted a cord and springjack switch-

board, known as the Williams' Standard. Some of us are yet in the harness who remember this board, and its groups of connecting strips painted with all the hues of the rainbow, and causing the historical coat of Joseph to pale with envy.

But in the larger cities many more of the lines were fitted with magneto bells—there was but a single style of receiving telephone; and for a transmitter we had firstly the box telephone, and from the beginning of 1879 the Blake transmitter. On the other hand, I have reason to believe that the lines constructed by the Bell exchange were not as substantial as those of the opposition. The wire used at that time was nearly all No. 12 galvanized iron; and the insulators were too frequently regarded merely as fastening attachments. While the glass insulator and rubber hook were freely used, the porcelain door knob attained also an undesirable prevalency.

It will be seen that each side had advantages as well as disadvantages The Bell people had an excellent magneto bell and generator, which, in fact, has proved so serviceable that its general style to this day has suffered no change; and a tower of strength in the fewness of their styles of telephone, towards the last, in the Blake transmitter, which could be efficiently operated with the lips at a distance, in contradistinction to the Edison instrument, which, though more powerful, had to be operated with the lips close to the mouthpiece—a proceeding not always pleasant—but the Western Union people had more experience, and as a rule better lines.

Consolidation came along in due course of time and a new era commenced; an era of rapid and legitimate growth; but the growth was too fast for good work, and was so tremendous that it deceived many of us into believing that the same rate of increase would last forever.

THE PLUG SWITCH-BOARD ERA.

The next stage in central office history which is to be referred to, I have called the plug switch-board era, because, in the first place, I do not know what else to call it; and because, in the second place, a revolution about this time seemed to sweep over the land; flexible conductor boards going into almost complete disuse, and plug boards being almost universally favored.

I should, however, have stated that during all the previous history of the exchanges, quite a number of the exchanges had developed switching systems of their own—all of course having the same ultimate aim and function, but accomplishing the said functions in different ways, and with different degrees of efficiency. These systems were each and all admired by at least one man. The deviser quite naturally thought there was no exchange system like his; and in truth he was generally correct in that idea. But this circumstance long proved a bar to uniformity, and was not likely to be a convenience when the time came to connect exchanges; for the manifest excellencies of our own system had a tendency to prevent us from perceiving the excellencies of our neighbor's board, which were not so manifest.

But the fruits of ill-considered and reckless construction and low rates began to be apparent. As stronger companies were formed they naturally formed executive committees. The strong points of the average executive committee of an electrical corporation are an innocence of electrical knowledge; quite too fre-

quently an inability to distinguish between the two words "Economy" and "Parisimony," and an indisposition to see that a dollar properly expended to-day means a good many saved throughout the year. Money was scarce; the lines must go up—and the cry was heard, "We must have a cheap switch-board, and cheap lines." The cry was heard, and we got a cheap switch-board—a plug switch-board. I think, that though the Gilliland plug switch-board was, so far as electrical connections went, by no means in the ideal condition of Cæsar's wife, it was still a necessity of the times. It answered well in the majority of cases; it was easy to understand; easy to handle; and everything about it was accessible. It was a great educator, and on the whole I think it was perhaps (for the reasons stated above) a better switch-board to have round than others more perfect electrically would have been

Its chief weakness was a looseness between the plug and its socket, but it must be confessed that this fault was plain to be seen, and in the power of exchange managers to rectify. Unfortunately many of them did not see the importance of rectifying it; and I have been in central offices where I could give a good blow with my breath, and blow a couple of dozen plugs out of their places.

A worse habit developed in this era; the habit of assuming that because the telephone would work as well as it does under the most adverse conditions we might therefore ignore the most ordinary precautions; give it a hard steel wire of any gauge from 14 to 20 to work over, insulate our lines with glass, rubber, porcelain knobs or nothing; neglect to solder ground connections or joints, and apparently try in every way to make it as difficult for the telephone current to exist as possible.

The fine steel wire mania, it is evident, grew up from the need of strong lines: and, as it was seen that steel was strong, the second idea was that as lines multiplied, available space to bestow them became scarce, and of course by using a fine or small wire we were enabled to put up a great many in a small space. Besides, when I go to Jones and tell him I want to attach a wire to his house, he'll let me much quicker if I show him a small one.

But the porcelain knob lunacy is not so easily accounted for. I suppose, first, the unsophisticated exchange man assumed that the only use of an insulator was that of an attachment; that he later undertook to study electricity and ascertained that porcelain was a non-conductor, and that thereupon he jumped to the conclusion that all porcelain articles must be well adapted for line insulators. How was he to know that the efficiency of an insulator depends as much on its form as on its material? That may be the way the door knob got into the saddle.

It stays there, because it does not cost much.

By 1882 wires were so multiplied as to be inconvenient. Cables were introduced, and here again we have had to be educated up to the proper point. When first introduced, we most frequently found in them a No. 26 conductor, no special insulation, and a wrapped external coating of doubtful durability.

In that year also the electric light industry began to assume importance, and we began to see that wherever a telephone wire and an electric light wire came into close conjunction with one another, the weakest went to the wall.

This lesson could not, however, be learnt, until an object lesson was given—and the Boston central station had to be practically destroyed before this subject was seriously considered, and proper measures taken for the prevention of such evils. In 1882 the American Bell Telephone Company and the Western Electric Company came into harmonious relations, and this paved the way for the improvement and completion of the multiple central office switch-board; and for the beginning of its general introduction into the larger exchanges.

During the period which has elapsed between that year and the present time the wheel of telephonic preference has again swung round; switch-boards having plug connectors have in a great measure gone out of favor; and flexible connection switching apparatus is once more preferred.

THE TELEPHONE EXCHANGE OF 1887.

And at the present time the majority of the larger exchanges are fitted with the multiple switch-board, some degree of uniformity being thus secured.

Look at the average exchange of the year of grace 1887, and then judge whether great progress has not been made during the decade, and also during the latter five years.

It is now almost universally recognized, that it is a good practice to conduct all or as many as possible of the converging wires into the central station by cables; and also to use cables to carry a number of wires to the district intended to be served.

This idea has largely been utilized during the last five years. By its adoption 3,000 lines can easily be conducted into an exchange, where otherwise it would be difficult to introduce 500. Nor is the advance in the number alone of the cables employed; where six years ago the size of the conductor and the character of the insulation were hardly considered, we now recognize the necessity of proper electrical dimensions; a high ratio of conductivity; a first class insulation and plenty of it; and a durable protecting envelope. If, as is in some cases true, these conditions are not obtained, it is not because their necessity is not recognized, but because the purchasing agent or the person or persons controlling the exchequer is by nature incapacitated from perceiving that in our business the best is also the cheapest.

Many of the exchanges of to-day are working a number of underground wires. By this practice we have all been educated. Some of us took the honors of underground wires spontaneously; others have had these honors thrust upon them. It cannot be denied that these underground wires show a certain amount of sluggishness in their working, but I do not think that inductive interference between wire and wire has been increased by the bunching of wires underground. Where interference has been intensified it has usually been traced to absolute leakage occurring at junctions between the underground and overhead sections, or in test-boxes or working vaults.

Our progress in underground construction must teach us the necessity of eternal vigilance in construction, especially as regards insulation. While I would not unnecessarily bury wires, I would get the necessary rights and franchises as much as possible, so as to be ready at any time.

The first-class exchanges of 1887, in addition to being fitted with lightning

arresters of proved virtue, are likewise provided with some form of protector against the destructive effect of dynamo currents; and it is gratifying to observe that some exchanges, at least, are beginning to see the necessity of protecting both ends of the line; a proceeding which, it will be remembered, I strongly advocated in my paper last year. An excellent form of protector for this purpose has been devised by Mr. I. H. Farnham of the New England Company, which consists, broadly stated, in using the heat developed in the bell magnet coils, to spring a circuit-changer which, according to its construction, opens or grounds the circuit or shunts the apparatus.

In our earlier years it was customary, even in large cities, to connect more than one instrument upon a circuit; and this practice gave rise to a number of inventions intended to individualize the signals, so that only the station called would hear the signal But these, while curiosities of electrical gymnastics, could not always be relied upon, and our experience of to-day shows that wherever attainable, for a number of reasons, the best individual signal is an individual line.

Another decided advance is the widespread recognition of the fact that intermediate bell magnets or auxiliary bells exercise a much greater retarding effect than is due to their resistance alone. This leads us to the conclusion that we must cut down the introduction of electro magnets as much as possible, and to the further conclusion that where they cannot be dispensed with, their helices should be connected in parallelism, wound with coarser wire, or shunted by a differentially wound resistance or by a condenser.

We may also, I think, congratulate ourselves on the almost universal use in heavily worked offices, of power generators or automatic pole-changers. Where five years ago only our largest offices possessed these labor-saving appliances, we now find them almost everywhere, and when we consider the ease with which power may now be made available, since we have to choose from the water motor, the gas engine. the electro-motor, energized from an adjacent dynamo, or the battery and pole-changer, it would seem blameworthy to allow any heavily worked office to go unsupplied.

It seems at this point fitting that I should call your attention to the care of the American Bell Telephone Co., which not only through its principal patents protects the main portion of the business, but continues to purchase from time to time such inventions as promise to be useful to its licensees.

The patent which covers the constantly operating generator or pole changer is a case in point.

Inter-urban lines and other long lines have during the history of the exchange wonderfully increased both in number and length; and with the general introduction of copper wires, more powerful transmitters, and greater intelligence in the users, are giving very satisfactory service. The use of the copper wire I regard as one of the most important advances in our history, and it is with considerable satisfaction that I once more point out that Mr. T. B. Doolittle, in advance of the age, strung a hard drawn copper telephone line in Ansonia, Conn., in 1878; and has always been the persistent advocate of copper line wire. It is proper also that I should call the attention of the Association to the fact, that the greater efficiency of copper lies not only in the lower specific

resistance of that metal, but also and chiefly in that it has a very low co-efficient of self induction—or in other words, a very small amount of magnetic inertia.

Lines are, I think, as a rule, better constructed now than formerly, and the advantage of giving the telephonic current a better path to travel over; and good insulation to retard the escape of the electrical excitement seems to be better appreciated than ever before. As to the service of to-day I prefer to say little. I think nearly every exchange is better fitted to give good service, and further, that the majority of exchanges do give good service. It is, however, true that good service needs close watching, as the best staff of operators requires discipline and constant supervision.

And I think the person in charge of the operating-room should in all cases be a male. First, because the chief should understand the electrical arrangements intellectually; and it is rare to find a woman capable of such an understanding.

Secondly, because I think operators will be more readily amenable to proper discipline when exercised by and insisted upon by a man.

Looking back upon the entire field, we cannot fail to see that, though sometimes it has not been easy to observe the progress from day to day, progress has certainly been made; for we are far ahead now of the point where we were either ten or five years ago. We have, however, to make further advance. It is not enough to know that small wire is not conducive either to stability or to good operation; it is not sufficient to know that the porcelain knob is not an insulator; it is not enough to realize that each company ought periodically to test its lines with the galvanometer, and to test for trouble with the same instrument in the hands of a competent electrician. It is not sufficient to know that competent electricians require more than sixty dollars a month; that line wire joints and ground connections ought to be soldered; that every part of your plant ought to be periodically inspected; that in your business the best supplies are always the cheapest. It is never sufficient only to know the right way. What possible avail can it be if the right thing is not done in the right way, by the right man and at the right time?

"If ye know these things, happy are ye if ye do them."

MR. BAILEY—I move that the paper of Mr. Lockwood be published in the proceedings of this meeting, and further, that the hearty thanks of the Association be tendered the gentlemen, Mr. Fay, Mr. Hall, Mr. Lockwood and General Barney for their able, interesting and instructive papers.

The motion was carried,

THE PRESIDENT—Does any gentleman wish to discuss the subject of the paper just read by Mr. Lockwood?

MR. HALL—I want to emphasize just one point that Mr. Lockwood made, and that is, that you cannot get a competent electrician for $60 a month; and I think one great dif-

ficulty with the telephone service to-day is that we have not a proper corps of men trained in the duties of their respective positions. We need better help all through the service, and it is necessary, in order to get good men, to pay them. We are not training up young men in the business. The material that is coming into the telephone service is not what it ought to be to give the best results and provide the men who in the future are to fill responsible positions in our companies.

MR. FAY—I would like to make one remark in reference to Mr. Lockwood's statement as to the effect of electro-magnets. I do not think that any member of the Association can do a better thing for himself and his service than to get Van Rysselberghe's treatise on the use of electro-magnets in his simultaneous system of telegraphy and telephony over the same wire, and get a thorough understanding of it. When pursuing the extraordinary effect that electro-magnets have on all small quantity currents in retarding them and diminishing them, by the use of electro-magnets and condensers, Van Rysselberghe was able to diminish the effect of a Morse current upon a wire over which a current passed, to such an extent that he could introduce a telephone in the same circuit and carry on conversation without being interrupted by the Morse telegraph, although the Morse signals were passing at the same time. This was due entirely to the retarding effect of the electro-magnet on the battery current as it came on the line. What an electro-magnet will do with a Morse current it will do with a telephone current. I do not think that the treatise is published in English. I have not seen an English copy of it. There was a brief review of it given in the "Electrical Review," I think, something over a year ago. But my attention was not called to it particularly until Mr. Ker. of Harrisburgh, sent me the French book, five or six months ago, and I had an opportunity to study it over. It was a revelation to me.

MR. PRESIDENT—The Convention has received an invitation from the Westinghouse Electric Company of this city, which reads as follows.

President of the National Telephone Exchange Association:

DEAR SIR :—

At your convenience and at any day or hour you may notify us of, we would be glad to have yourself and delegates visit our works at Garrison alley and Duquesue Way, this city, in order to investigate the details of our new alternate current system for incandescent electric lighting.

Yours truly,

THE WESTINGHOUSE ELECTRIC COMPANY,

by H. M. BYLLESBY,

Vice-President.

I do not know, unless the proceedings of the Convention be lengthened out until Wednesday, that we will have much time to avail ourselves of this kind invitation. I presume the time of the Convention will be taken up to-morrow with the reading of several papers, and then there is the excursion in the afternoon. It may possibly be that we will not get through with our business to-morrow, and we could avail ourselves of this invitation on Wednesday, or at least such members of the Convention as choose to remain. I think it would be well worthy of a visit from the members of the Convention, to examine and look into this alternate current system, though I presume you all understand more or less about it. The Secretary suggests that so far as the reading of papers is concerned there is no doubt of our getting through to-morrow at one o'clock at latest. If there is any other business that is likely to come before the Convention it would be an advantage for us to know it in time.

MR. TYLER—Regarding this invitation of the Westinghouse Electric Company, I would suggest that the Secretary be instructed to acknowledge the invitation, with the thanks of the Association, and express the hope of the Association that the members will be able to accept it. I do not see that we can do anything more about it.

MR. BAILEY—I would supplement that by suggesting that the President be requested to arrange for the actual acceptance of the invitation, if possible, and to arrange the details as to time.

THE PRESIDENT—Do you accept the amendment of Mr. Bailey?

MR. TYLER—Yes, sir.

THE PRESIDENT—The question before the house is the motion of Mr. Tyler, amended by Mr. Bailey, that the President of the Association be instructed to accept the invitation of the Westinghouse Electric Company, with the thanks of the Association, and that we make arrangements to avail ourselves of it if possible.

The motion was carried.

The meeting then adjourned until the following day, at 10 A. M.

SECOND DAY'S PROCEEDINGS.

TUESDAY, September 27, 1887.

The meeting was called to order at 10 A. M., President Metzger in the chair.

THE PRESIDENT—The hour of meeting having arrived, the Association will now come to order. Before proceeding to the regular order of the day the Secretary will read a few invitations and letters on various subjects. The Association can take proper action on the same.

The Secretary then read the following telegram from the editor of the *Electrical Review :*

NEW YORK, September 26, 1887.

TO HENRY METZGER,
Vice-President Telephone Convention,
Monongahela House, Pittsburgh.

Best regards to old pioneers of telephone field. May their deliberations be as fruitful and valuable as the grand gatherings of the past.

GEORGE WORTHINGTON.

Also the following letters ;

THE CITY AND SUBURBAN TELEGRAPH ASSOCIATION,
CINCINNATI, September 21, 1887.

The National Telephone Exchange Association, C. H. Barney, Secretary:

DEAR SIR—I have your notice of the meeting of the Executive Committee and regret very much it will be quite impossible for me to be present.

I am engaged changing one of our exchanges from the Jones to the Western Electric single cord multiple system, which will require my personal attention.

I cannot afford to miss any of the good things in this world, and therefore exceedingly regret I cannot attend the meeting at Pittsburgh.

With best wishes for the National Telephone Exchange Association's success, and with personal regards.

I am, very truly,

G. N. STONE.

TELEPHONE AND TELEGRAPH CONSTRUCTION COMPANY,
DETROIT, MICH., September 24, 1887.

GENERAL C. H. BARNEY,
Pittsburgh, Pa.

MY DEAR SIR—I exceedingly regret that important matters have suddenly arisen requiring my immediate attention at other points, and will not enable me to be present at Pittsburgh. My whole heart and best wishes are with you as ever, and hope you will have an excellent time. Please remember me to all kindly. With kind regards to yourself, I am,

Very truly yours,

W. A. JACKSON.

PITTSBURGH, September 26, 1887.

To the President of the National Telephone Exchange Association,
Monongahela House.

DEAR SIR—We wish to extend an invitation to the members of your Association to visit our works during their stay in the city.

Any who desire can obtain permits by calling at the General Office, 801 Bingham street.

Very truly yours,
OLIVER & ROBERTS WIRE CO. (Limited),
GEORGE T. OLIVER,
Vice-Chairman.

THE ALLEGHENY COUNTY LIGHT CO.,
PITTSBURGH, PA., Sept. 26, 1887.

MR. HENRY METZGER,
President National Telephone Association, City

DEAR SIR—We desire to extend to the members of your Association an invitation to visit our station, at such time as may be most convenient for them, during their stay in our city, and if advised of the time fixed for the visit, we will have our proper officers meet them, and give them any information desired regarding the operations of the plant.

Very truly yours,
THE ALLEGHENY COUNTY LIGHT CO.,
By ROBT. D. MCGONNIGLE,
Secretary.

THE PRESIDENT—Gentlemen, you have heard the letters of regret from Mr. George N. Stone and Mr. W. A. Jackson and the telegram of congratulation from Mr. Worthington, of the *Electrical Review*. What is the pleasure of the Convention?

A MEMBER—I move that they be received and filed.

The motion was carried.

THE PRESIDENT—You have also heard the invitations of the Oliver & Roberts Wire Company and the Allegheny County Light Company, What is the pleasure of the Convention in respect thereto?

MR. EASTABROOK—I move that the thanks of the Association be extended to these gentlemen for their kind invitations, and that it be left discretionary with the members individually whether to avail themselves of them or not.

The motion was carried.

THE PRESIDENT—In pursuance of the motion passed yesterday the President accepted the invitation tendered by the Westinghouse Electric Company and notified Mr. Byllesby, the Vice-President of the Company, that those members who remained over until to-morrow would gladly avail themselves of the opportunity to visit the works between the hours of ten and eleven o'clock in the morning. The next regular business before the Convention is the naming of the place for the next annual meeting. The Secretary will read the invitations which we have received from different places.

GENERAL C. H. BARNEY,

Secretary National Telephone Exchange Association,

DEAR SIR—I desire, on behalf of the Erie Telegraph and Telephone Company, to extend an invitation to the National Telephone Exchange Association to hold its next annual session at Minneapolis, Minn. If this invitation is accepted, I would like to suggest that the Convention be held some time between the 12th and 18th of September, that being a very pleasant time of year to visit Minneapolis, and a time that the officers of our Company will be in that city.

Yours truly,

J. W. BENNETT,
President.

C. N. FAY, ESQ.,
President National Telephone Exchange Association,
Pittsburgh,

The Metropolitan Telegraph and Telephone Company cordially invite the Association to meet in New York next year.

THEODORE N. VAIL,
President.

C. H. BARNEY, ESQ.,
Secretary National Telephone Exchange Association.

DEAR SIR—Understanding that New York has been suggested for the next gathering of your Association, I write to say that in case this city should be selected, the Electrical Club cordially tenders the use of its parlors as a place of meeting, and will extend the full privileges of its new club house, No. 17 East Twenty-second street, to all your delegates while in this City.

Yours respectfully,
HENRY C. DAVIS,
President.

THE PRESIDENT—The Association has heard the invitations read. What is the pleasure of the Association ?

MR. SEELEY—Mr. President and gentlemen of the Convention : I would like to call the attention of the members to the fact that I think New York would be the proper place to hold the next convention. The developments in the telephone business during the last year and the year to come have been and will be marvellous. We will probably have over 5,000 complete metallic circuits working in one large exchange, and the largest switch-board in the world. We will also have the largest electric light plant in the city working from electrical accumulators, consisting of about 600 cells. Mr. Hall and Mr. Hibbard will also extend the courtesies to the Convention. We have ample hotel accommodations and sights of all kinds.

MR. BENNETT—Mr. President and gentlemen of the Association: On behalf of the Erie Telegraph and Telephone Company I sent a communication to the Association to hold its next annual meeting at Minneapolis, Minn. I must say that New York can afford better electric light facilities than Minneapolis ; but when it comes to palace hotels there is not any place in the world that can exceed Minneapolis, And then we have Minnehaha Falls—water

falls. Gentlemen, there is no place in the world that has thrived and grown as fast as Minneapolis in the last ten years. There is no other place that you gentlemen can go, where you will find more hospitable people than we will show you in Minneapolis. We will show you where your flour is made. We will show you St. Paul, and I dare say that to a telephone fraternity St. Paul will be a curiosity. Then on our way out we can stop at small Chicago. We can see the new switch-board that we hope President Fay, of Chicago, will have. We will show you in Minneapolis one thing that is far ahead of New York. In 1883 we put in a multiple switch there—away out on the prairies—and we continued to add to it, and ordered another section last week. And then there is another thing, gentlemen; the Erie Company stands second on the list for gain in subscribers, all over the country, in the last twelve months. I would suggest to the President of the Association that he appoint the New York gentleman and myself a committee to receive, assort and count the votes.

MR. FAY—Mr. Bennett has ably set forth the attractions of Minneapolis, and he has in no small degree added to those attractions by suggesting those of Chicago thrown in gratis. At the same time, in all things, justice should be done, and there is a little inside history in this matter of location of the Convention which is familiar to those who have been on the Executive Committee for a number of years. For several years New York has been suggested every year as the meeting place of the Association, and each year we have deferred in favor of other points, sometimes westward and sometimes eastward. The principal reason, however, which decided the Committee in all cases, was that under the old arrangement the date fixed for the assembling of the Convention was too early in the season to be agreeable for New York or any city similarly situated. We wanted to go to a cooler climate, and therefore a year ago, or two years ago, an amendment to the Constitution was proposed leaving us free to move the date, the idea being to take advantage of the seaboard cities, and particularly the great city of New

York. The change was made, and New York has waited patiently for her turn now a number of years. The next year she will have peculiar attractions—those which Mr. Seeley has described; and while it would suit my personal convenience eminently to go to Minneapolis—it is a charming city and near at hand, and in every way a most desirable one for the Association to visit—still I think that this year she ought to be content to wait, as St. Louis did and as New York has done, for another year.

MR. LOCKWOOD—I cannot spread the glories of either city in the able way in which Mr. Seeley has dilated upon the wonders of New York, and in which Mr. Bennett has eloquently pictured the attractions of Minneapolis. But I do not think that the present meeting of the Telephone Exchange Association should be in any way biased or influenced by the delinquencies or the acts (delinquencies or otherwise) of previous executive committees. New York, as we are advised by the daily papers, is the commercial emporium of the country. It is the only city that nearly all members of the Telephone Exchange Association can visit individually at any time, and that they do visit individually quite frequently. It no doubt has a great many sights, as Mr. Seeley has observed; but with respect to the wonderful advances in telephony, which have been made there, and which will be made there in the next year, I think it is worthy of consideration to note that they can be better observed when visited by a few at a time. More attention can then be paid to every individual that goes there. The metallic circuits can be equally well seen if members visit the place individually. The switch-board can be explained more in detail if one gentleman goes there alone; he will learn more about it. Minneapolis, on the other hand, is a place that we cannot all visit readily. It would afford us a chance of visiting Minneapolis and of renewing our acquaintance with St. Paul that does not often happen to us. I may say that I was somewhat surprised to hear a man advocate Minneapolis and St. Paul in the same breath, because I have heard that a pastor in Minneapolis was discharged from his church, because

he quoted St. Paul in his sermon. It will be a good chance for the gentlemen to get acquainted with Chicago, and very few of us have had a chance of knowing much about Chicago. I have not been there since 1885, and I should like to see how Chicago has grown. I do believe that Minneapolis is the place to vote for.

MR. SARGENT—I would like to say a word in favor of our meeting next year in New York. As Mr. Fay has well said, it has been considered for a number of years, and the invitations we have received to go to other places have been deferred for one year or more, as in your case, Mr. President, also in case of St. Louis, and I think, taking all things into consideration, it would be better and pleasanter for us to meet next year in New York, and go to Minneapolis the following year. I have no doubt that when you visit New York, the Metropolitan Company will show you Brooklyn, as the Minneapolis people will show you St. Paul.

MR. HALL, JR.—It has been a custom of the Association to meet in alternate years in the East. We met last year in St. Louis, and this year we are in Pittsburgh. I think that it would be entirely proper and right if the Convention next year should be held somewhere in the East. I think the consideration of this question should be not as to the pleasures of the trip for the members of this Association individually, but as to where they can go for the best interest of the Association, and where most can be learned about the telephone business—where we can see more and learn more which will be of profit. The developments in New York and in the vicinity, in telephone matters, will be greater in the next year than the development has been in any part of the country in the last five years. There will be more that is new to show telephone men; the underground system and all the latest appliances in telephone works will be seen in New York next year at their best, and I am heartily in favor of having the Convention meet there.

MR. EASTABROOK—There seems to have been no motion yet put. To get this in shape for voting, I move that the

Secretary be instructed to call the roll of delegates present, and that each delegate name the place of his choice.

THE PRESIDENT—It must be borne in mind that none but active members of the Association can vote on this question.

The motion was carried.

MR. CHERRY—I think this is one of the things on which associate members have a right to vote. Am I correct in that? We have but few privileges and ask for few, but it seems to me that this is one of the luxuries that we are entitled to.

THE PRESIDENT—For the information of Mr. Cherry I would say that Art. XVIII. of the Constitution, providing for associate membership, says;

"An associate member shall have no vote in the meet-
"ings of the Association, but shall be entitled to all the
"other privileges of regular members except during execu-
"tive sessions, and shall be subject to the same dues and
"assessments."

You can talk, but you cannot vote.

MR. BAILEY—I would like to suggest, in order to avoid any errors in the vote, that cards be distributed to the members of the Association on which to write their preferences.

THE PRESIDENT—The question can be settled by calling the roll and voting *viva voce*.

MR. BAILEY—I move that we reconsider the vote just taken.

Mr. Bailey's motion was not seconded.

MR. GLIDDEN—Before the vote is taken I would like to suggest that 50 per cent. of the usual number of absentees be counted for Minneapolis, as the absentees are mostly from the West.

The Secretary then called the roll. Fourteen members voted for New York and ten for Minneapolis.

THE PRESIDENT—The Secretary announces the result of the vote—New York 14, Minneapolis 10, so we will meet in New York.

MR. BENNETT—We accept the position, and we hope that

New York will give us as good a time as they have promised us. This is the only way to settle the question—by ballot; it is the most democratic way to settle it.

MR. SEELEY—I can assure you in behalf of the Metropolitan Telephone Company that we feel very much flattered and shall endeavor to extend the courtesies of the city, and we will show you all sizes of elephants.

THE PRESIDENT—The next matter to be decided is the time of meeting.

MR. BAILEY—It has been customary for the last one or two years to allow the time of meeting to be decided upon by the Executive Committee. I would suggest that, owing to the various circumstances of the case, that precedent be followed.

MR. EASTABROOK—Does not the Constitution or By-Laws provide that the Executive Committee shall provide the place?

THE SECRETARY—Article XIII. says: "The Association at its annual meeting, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting."

MR. GIFFORD—I believe that last year it was decided by the Association that the Executive Committee should have power to arrange the time of meeting, and I think that ought to be followed this year. We cannot decide as well as the Executive Committee can, after more mature consideration.

MR. EASTABROOK—I move that the subject be referred to the Executive Committee, with power.

The motion was carried.

THE PRESIDENT—The first paper to be read to-day is by Dr. Allan V. Garratt, an explanation of the new system of designating and ordering wire. Is Mr. Garratt present?

MR. GARRATT—Mr. President and members of the National Telephone Exchange Association: When I received the very courteous invitation, through your Secretary, to address you to-day, I was pleased with it as a mark of personal attention. Upon a moment's reflection,

however, I saw that it was dictated by a desire to call out the opinion and attitude of the National Electric Light Association in regard to the subject of wire gauge, and therefore I say in the name of that body, greeting. I shall so far as possible voice their views, keeping out of the question what I may personally think or believe. When he stood up to advance those principles of astronomical science that have since made him world-renowned, Sir John Herschell said that when any student enters upon a scientific pursuit, especially at a somewhat advanced period of life, he will find that he not only has much to learn, but much also to unlearn, and as a first preparation, therefore, for the course he is about to commence he must loosen his hold on all crude and hastily adopted notions, and must strengthen himself by something of an effort and a resolve for the unprejudiced admission of any conclusion which shall appear to be supported by careful observation and logical deduction, even should it prove of a nature adverse to notions he may have formed for himself, or have taken up without consideration upon the credit of others. That, in fact, is the beginning of that intellectual discipline which forms one of the most important ends of all science. So I would say to you to-day, let us lay aside the traditions which are the common stock of us all in regard to the subject of gauging wires and look at it from a broader standpoint. We are all sick of the wire gauge question—at all events, the electric light men are, I do not know how it may be with the telephone men; because it seems to be a matter of infinite perplexity, and the more we discuss it and the more we legislate about it the less we really accomplish; and perhaps the first thing which the National Electric Light Association resolved is this, that there is no use at all in attempting to legislate about wire gauges. Such legislation seems to have no more effect than the wind blowing over the house. This Association has practically so resolved. In 1886 the Electric Light Association passed such a resolution. Such attempts proved thoroughly fruitless, and we abandoned them entirely. The next thing that we made up our mind to, was, that we did

not want a gauge any way. It seems to be the tendency of the age to express dimensions of all kinds, in trade, by the simplest possible application of the best unit of measure. That belief we have come to from having corresponded with nearly everybody who was personally interested in this subject, and the almost universal reply to letters sent out upon the wire gauge question has been that they wished to hear nothing more of wire gauges. Perhaps the next most common reply was: we prefer to designate our wires by their simple diameters, and usually the reply was expressed in the thousands of an inch. Personally, I have corresponded with nearly all the wire makers, drawers, coverers, and electric light companies, in regard to the use of the metric system, and I find the objection is raised that they are unfamiliar with the metre. Few men carry a mental picture of how long it is. They cannot put out their hands and say, that is a metre, but when I asked them: Can you tell how long a thousandth part of an inch is? The reply is, no; we cannot do that either. Can you draw on a piece of paper twenty-seven thousandths of an inch? No. Well, isn't it just as unfamiliar a unit to you as a millimetre? Yes. They say it is; that small unit of a thousandth of an inch is an unfamiliar one to almost every one, except to machinists who are working to thousandths of an inch in construction at all times, and we have come to that conclusion that that unfamiliar unit is not particularly in the way of adopting a system which shall include its use. Six months ago, at Philadelphia, I presented a view something the same as I have this morning, only elaborated in a long argument, which would be impertinent here, and I was instructed by the National Electric Light Association to go ahead with my associates and prepare a mathematical table based upon the views adopted at that Convention. I have done so, and through the courtesy of the *Electrical Review*, who own an electrotype of it, it is before you this morning. I suppose there is nothing I know so little about as the telephone. I do not know anything about your requirements for wire or how close you have to

work, or whether you have to work at all by sizes of wire or anything of the kind. In incandescent electric light work it is a matter of the most vital importance. We are obliged to work to the utmost nicety in regard to the sizes of wires, and I am familiar with those requirements and could present them here, but I take it it would be a matter of no interest whatever, and hence I will not enter upon the subject. I understand that, in telephoning, the question of static capacity comes in in your engineering work. I much regret my inability to speak upon that subject. It is something entirely out of my field of work, and other than the ordinary theoretical principles I know nothing whatever about it. I trust that it will be brought up upon this floor and will be discussed. About all I can say in regard to these tables is in regard to the way they are made up. Of course, in introducing a thing of this kind, we had to be extremely careful that the utmost nicety of accuracy should be used. Nearly all the gauge questions of wire fall back upon weight against conductivity, or conductivity against weight. The figures used in this compilation of conductivity, or rather its reciprocal resistance, was the last authoritative determination in regard to the legal ohm. The work was calculated independently by three members of the Committee, so that the table you see before you is not the result of one calculation, but the result of three independent calculations. Of course, they did not agree at all points. Where they did not agree I myself independently calculated those same sizes on different days, so that I might have forgotten the figures, and if both of my calculations agreed with either of the others, the rest of the Committee went over the figures and they were adopted. That style of work has gone through the entire table. So I suppose I may say without egotism that it is an accurate set of figures. It was not printed from type; it was printed from electrotype, where there was no possibility of dropping out of type afterwards. Hence, I suppose, we may look upon it as a fairly accurate compilation. The idea of our Association in regard to its use is this—not to adopt it as a gauge. You cannot expect the workman in

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our shops to carry about this great piece of paper in his pocket and base all his work upon it. We realize that the introduction of anything of this kind cannot be revolutionary, any more than forms of Government can be revolutionary—or only exceptionally so. It must be a question of slow growth, and the electric light men, as represented in their Convention, have virtually voted to do this—to accept these figures as the work of their Committee, and in so far as they can do so, without directly interfering with their business workings, to specify such wires as they may require in their simple diameter expressed in the tenth of a millimetre and to use the figures which are set opposite those numbers of resistance, weight and so on, as the legal resistance, weight, etc., of wires of that particular size. That, you will see is an extremely conservative position to take. It was so, and I have heard gentlemen say to me; "Mr. Garratt, I am sorry that the National Electric Light Association did not adopt in a more positive way the work which you spent so much time in preparing," and I have replied honestly, as I say now, that I think the National Electric Light Association went as far as conservative men could go in a question of this kind, and their idea in using it is this—where the even tenths of a millimetre brings a wire sufficiently close to the wire they want, order directly by the number which appears on column one at the left, which we call the Gauge Number. There is really no gauge. You will notice number 19 is one and nine-tenths of a millimetre. In telegraphing it is difficult to make telegraph operators put in a decimal point. A decimal point is always a possibility of error, and it is simpler to say No. 19. So there is a definite set of consecutive numbers which may be used in ordinary work. In talking with a great diversity of people on this subject, I find this—they say that the telephone men will have certain sizes of wire which they must use; the incandescent light men of one particular system must have wires of a certain size; the arc light men will have another; men who make hair-pins will have another. They do not care anything about gauge; simply give them something where-

by they can express wires of a particular size in the simplest possible way. Now in regard to the smaller part of this gauge, in the numbers reading from 1 up to 10 and so on, I received, I suppose, a bushel or two of letters from gentlemen, courteous letters, which I have been glad to receive, stating, "Your numbers do not come close enough together: we have six numbers in the Birmingham between the two smallest numbers of this gauge." That is very true. It so happens that neither of those Birmingham numbers, however, exactly correspond with what you want. So instead of ordering No. 1 wire (metric) it is very probable that a man ordering wire of a small size would specify .123, which would mean 123 tenths of a millimetre. By the simple rule of three, as 1 is to the property it possesses (see table,) so will 1 to 1.23 be to the property you want to find out. By a simple proportion from this table you have here, you can almost instantly calculate the physical and electrical property of any wire that you want. That is the way that such a table has to be used. I have not the remotest idea that in the very small wires any gauge will ever be adhered to. To my knowledge there are some 14 Birmingham gauges in use in England. By that I mean there are some 14 different makers who sell wires on what they call the Birmingham gauge that differ from one another. In this country the Brown & Sharpe gauge is not accurately used by makers. Wire drawers who do not live a thousand miles away from Messrs. Brown & Sharpe differ much from Brown & Sharpe themselves in the size of their wires, which they list under B. & S. numbers. There is one wire maker who draws excellent wire, and whom I greatly esteem, and on his table more than half the sizes of wire that he gives differs from the same sizes as given by Messrs. Brown & Sharpe themselves. Those arbitrary gauges to-day, mean almost nothing. You can take your micrometer screw and go into any large dealer's shop and say you want No. 23 Brown & Sharpe wire, and they will show you a lot of it, and if you want to work finely in incandescent work you can pick out just the wire you want. I mentioned 23, because that is a number they do not ordinarily carry. Those numbers are

not drawn absolutely, I am told by wiremen. It is impossible, perhaps, to draw them so. So that after all an arbitrary number means but very little. That I merely introduced as an argument against a rigid adherence to an arbitrary number which bears no relation whatever to electrical or physical properties of the wire you are going to designate. I do not think you will care, gentlemen, to have me go into these various tables here, which were prepared almost exclusively for electric light work. The length per weight, of course, is a very pertinent thing to a telephone line and also the weight per mile. The sectional area and diameters are matters of simple mathematical calculation. I would say, by the way, that not only were these calculations made by different members of the committee, but calculated by different formulæ. Of course that made a check against any possible accident in this question of area. But the conductivity against the length and weight, I take it, is not of so much interest to you. If it is, I will enter upon that subject. Along to the right, the logarithms of sectional area, etc., are introduced for the benefit of mathematicians and electricians to save them the trouble of hunting up the logarithms for their own use. This column, No. 16, is simply put in for incandescent men—line men. From the number given there it is the simplest thing in the world to calculate roughly the questions of resistance and conductivity. Over to the right, to familiarize ourselves with this way of designating in comparison with the Brown & Sharpe and Birmingham gauges, I have put tables of the nearest corresponding number of the Brown & Sharpe and the Birmingham gauges, and where there are half a dozen numbers of the Brown & Sharpe and Birmingham that correspond to one on this metric table, I have figured that very accurately, so that where it leaves off No. 3 and begins No. 4 of Brown & Sharpe's gauge, that is figured out to a nicety, so that you can tell which is absolutely the nearest number. As I say, I know very little about your department of electrical work, and hence am somewhat embarrassed. I should be most glad, however, to answer any questions or cover any points which I may have omitted, or which it may be desired to know.

I thank you, gentlemen, for listening to a matter which is a very old story.

MR. BAILEY—I move that the thanks of the Association be tendered to Dr. Garratt for his able discourse on the subject of gauges.

The motion was carried.

MR. LOCKWOOD—I am very sure, Mr. President and gentlemen, that we all highly appreciate the action of our Secretary, or the Executive Committee of the Association, in inviting Mr. Garratt to address us on the subject. The gentleman has been so good as to say that he knew little or nothing about the telephone. I do not think we need necessarily coincide in the gentleman's views. What he has said shows that he at least understands the rudiments, and I think that we have only taken the proper course in thanking the gentleman for the remarks which he has tendered us.

It will be remembered that some time ago, at previous meetings of the Association, we adopted officially what has been known as the standard wire gauge. I was then one of the most strenuous advocates of that gauge. I can follow Mr. Gladstone in this, and I think it is about the only thing I can follow him in, that when I see I have taken a wrong stand I like to be one of the first to confess it. I agree with Mr. Garratt, certainly, in this—that at the present time the wire gauge question is one which might as well be dropped. Everyone who has had anything to do with it is fully as sick as he is of the subject. It is one thing to adopt wire gauges or any other measurements and another thing to get people to use them. It seems to me that there are two points which cover the entire ground of this question. The first of these main features is, that it is necessary that every gentleman ordering wire should know what kind of wire he wants. The corollary of that is, that every manufacturer when he undertakes to fill an order for wire, should know what kind of wire the person that ordered it wants. That brings me to the second main feature, which is, the very apparent necessity of having some formula whereby telegraphic orders can be

sent, necessitating a very small number of words—a short message—which shall at the same time be concise and clear. My friend, Mr. Pope, tells me that frequently they have orders come in calling for a No. 4 copper wire without a word as to which No. 4 is wanted. It seems, therefore, that the requisite of a gauge is that it shall be something which shall express intelligently and intelligibly what kind of wire is really wanted and what size of conductor, and we also need to know what material. This I think Mr. Garratt coincides in, as I find by reference to his paper before the Electric Light Convention, that he said the object of giving these numbers which appeared in the paper before us, is "that in sending telegraphic despatches I find it is almost impossible for a telegraph operator to use a decimal point. It is almost impossible also, in hasty writing, to get the decimal point in the right place. For common purposes, in speaking of wire in ordinary business parlance, a simple number is more convenient than a number with a decimal point. For this reason a column of figures is here placed with that decimal point removed." It seems, therefore, simply to come to this, that if we can get a series of numbers, and weights, and letters which shall express unmistakably the kind of wire that is wanted, and if we can get gentlemen to make use of a common code, all that is wanted is done. I find that I cannot altogether agree with Mr. Garratt any further. All who are here learned long measure when they were boys. We learned that three barley-corns make one inch, that twelve inches make one foot; three feet one yard, and so on. Very few people in ordinary life (when I say ordinary life I mean anything out of colleges or scientific institutions) know much practically, as Mr. Garratt has well said, about a meter. The only metre we know much about is the gas meter, and that we know about to our sorrow. But he went on to say, however, that if we would consider a moment we would find that we knew just as little about thousandths of an inch. That, I think, is the weak point in his armor when advocating the metric system. It is quite true we may know very little about thousandths of an inch, but we know con-

siderable about an inch. We know very well what the length of an inch is, and what the length of a foot, or a yard, or a mile is. So the objection, it seems to me, falls to the ground. We know what the inch is. Although we cannot picture the length of a thousandth of an inch, we can form a mental image of what a thousandth of an inch might be. I have heard it stated in behalf of this metric system that it is a decimal system; that sooner or later we must come to a decimal system; we must be ready to take the system of the future. It seems to me that while we are speaking of the future, we must also live in the present. We have got the inch before us, and there is no more reason why we should not express fractions of an inch decimally than fractions of a metre. A thousandth of an inch is none the less a decimal fraction, because the inch happens to be the unit that it is taken from. Going a little further we find that the thousandth of an inch has grown into regular use as the unit for ordering wire by. We can specify the dimensions; we can specify the diameter we want. It is very easy, if we want to know what the sectional area is, to square the diameter. I find that we just as frequently want to know the diameter of a wire as the sectional area. If then we have the sectional area and want the diameter, we have got to divide, or make some other arithmetical calculation, which will give us the diameter, and the squaring of the diameter to get the area is, I think, easier than getting the diameter from the area. The great point in favor of the thousandth of an inch is, that we are all accustomed to think of it. It is before us; we have nothing else to learn.

Another point against the metric system, is, that consistency is a jewel. If we take the millimetre or the metric system as a measurement of sectional area or diameter, and do not measure the length of the wire by that system, we are measuring the cross-section of the wire by one system and the length by another. If we are in Mexico, or France, where we measure by kilometres, it is a different thing, but we do not need to go out of the Anglo-Saxon language to

get the length of a wire. If we keep inches and yards and miles for length, I think that we should stick to it for the sectional area and diameter also.

As to what was adopted in the Electric Light Convention, I would like to read the resolution which was passed. Mr. Phelps said:

"I have a resolution to present, as follows:

"*Resolved*, That the report of the Committee on Wire "Gauge be received and the Committee discharged with the "hearty thanks of this Association for the valuable work ac- "complished by them and presented in their tables."

I would like here to add my word of appreciation of this table. I think it is an invaluable addition to the literature of the electrical age. There must certainly have been an immense amount of work expended upon it. All of it is work that is good work, and we can rely upon the figures. The resolution continued:

"It is further resolved, in view of the large number of "gauges already in existence, and the confusion arising in "their use, that it would in the judgment of the Association "be inexpedient to promulgate an additional gauge."

We can all concur in that I am sure. The resolution went on:

"The Association earnestly recommends to its members "and all others using copper wire, the practice of designat- "ing sizes by definite diameters, such practice having already "come into extensive use, as a possible escape from confu- "sion among gauges."

I am sure that every member of this Association will concur in that. The Electric Light Association, however, recommends the use of the metric gauge and its fractions in designating diameters, and in furtherance of that end publishes the tables presented by this Wire Gauge Committee.

I may say in conclusion, and you will expect it from what I have already said, that I totally dissent from that. We have got a unit which is a good unit, and which is an understood unit, and I think we should stick to it until we find a better.

MR. GARRATT—I am obliged to Mr. Lockwood for reminding me of several things I forgot to say, and one of them was this: The chief reason for adopting the metric gauge was not the fact that is now the recognized scientific unit of the world, which is the case—that it is in use in nearly all of the countries of Europe by the common people, or that it is in use all over the world by everyone who makes any pretence to scientific attainments, but it was this: The wire gauge that we were considering was more especially designed for electrical purposes—not so much for makers of screws, and hair-pins, and things of that kind. All our electrical units are based upon the metre—the ampere, the ohm, the watt, the coulomb—they are all based upon the metric system. It is called the centigramme-metre-second-system. The unit of weight, the gramme, the unit of length, the metre, are now recognized not only in the electrical world, but in the whole scientific world as the units, and not only recognized as such, but used every day, and electrical engineers in calculating the static capacity of a wire have got—(it is not a question of option)—have got to use the metric system. There is no other way. The gentleman said that a simple way of calculating the sectional area of a wire was by squaring the diameter. Would to God that it was so. Unfortunately, squaring the diameter of a wire will not give its sectional area. If I misunderstood the gentleman——

MR. LOCKWOOD—If I may interrupt the gentleman, I would like to say that I left it to the intelligence of the meeting, to put in the decimal and cut off the corners.

MR. GARRATT—I never could get that into anybody's head. That is the reason why we calculate the area rather than leave it to workmen. I am obliged to Mr. Lockwood for his remarks.

MR. SARGENT—I had the honor, or the misfortune, to do some work in connection with the wire gauge for this Association, and while I wish to pay tribute to the work that has been done by Mr. Garratt, and do appreciate it to its fullest extent, and believe that the table will be very valuable in

various ways, our Committee considered that their duty was to select one gauge and adopt it, and, if possible, get rid of the multiplicity of gauges that were then in existence; and in doing so, they took the experience of the electrical engineers in England and formulated their report largely on the results obtained by them, and the result of the report was that they recommended the adoption of the English standard gauge, and the Association did adopt it. What makes the question very tiresome to me is, that after having adopted it, not a member of the Association, with the exception of myself and one other gentleman, I believe, has ever seen fit to use that gauge. I believe that in the whole United States we two are the only ones who are consistent with the declaration of the Association and use that gauge. Now, I think the common sense view of the situation is simply this, that there are about three well-known and well-recognized gauges; that it would be a comparatively simple matter for any user of wire to say that they will use that one particular gauge, and the convenience, of course, is in the numerals to be used in ordering the wire and the ease with which they can be remembered. For all exact work, such as Mr. Garratt speaks of, for electric light work, and probably in the future for our work, when we come to very exact work in connection with the long distance lines, we will order, measure and expect to get exact sizes by thousandths of an inch, and all correct work will have to be done that way. But I do not see that we need do away with the ordinary wire gauge with its convenient numbers.

MR. DOOLITTLE—In this matter of wire gauges, as Mr. Sargent says, we took up the subject some two years ago, and appointed a committee upon which I had the honor to serve. I had occasion to differ somewhat from the views of the majority, and I would like to say now, that up to the time of the introduction of the micrometer gauge the fixed gauge was a necessity. Since the introduction of the micrometer gauge, the fixed gauge has been simply a matter of convenience.

The method of designating the sizes of wire by gauge had

been in a state of chaos from time immemorial, when Messrs. Brown & Sharpe undertook to harmonize the gradation of wires in order that there might be a regular progression of sizes. The work, imperfect as it was, in some respects, was seconded by the manufacturers, and at a meeting of the brass and copper wire interests, it was voted to adopt the Brown & Sharpe or American gauge as the standard for brass and copper wire, sheet metal, etc. After about a quarter of a century, and throughout the United States, this has become the accepted gauge for those industries, and it only remains for the iron and steel interests to wheel into line.

I was in favor of the recognition by the Telephone Association of the American gauge, for the reason that it had gained so strong a foothold in the wire industry, and simply as a matter of convenience to designate the different sizes which are represented in our department of the wire trade. We could not hope to promulgate a specific gauge for use in the general trade when our consumption is so small a fraction of the total amount manufactured.

We order now by the micrometer gauge in one thousandths of an inch, but we designate the wire by numbers, and for present purposes it only needs to be understood to what gauge we refer.

The desirability of a uniform standard of gauge for wire is unquestioned, but in my opinion the time has not arrived when we can consummate the desired end. As I argued before, it is only a question of time when the metric system will be recognized as the only general system of measure ment, and any gauge for universal adoption must be based upon it. We can only show to posterity that we are fully alive to the necessities of the case, and leave it for them to adjust. In conclusion, I can only admonish those who are ordering wire by numbers, to designate the gauge which they employ, whether it be the American, Birmingham or others. This will save a vast amount of confusion that now exists, and help to tide over to the time when a uniformity may be secured.

MR. R. W. POPE—It is now generally admitted that the principal obstacle encountered in the effort to adopt a uni-

versal wire gauge is the difficulty experienced in gaining the general support of such a measure by all the people interested, whether they be the actual users of the wire, the dealers or the manufacturers. Every attempt to introduce a new gauge simply adds to the complex character of the problem by increasing the number of gauges, which is already too large, and the reduction of which is the reform we are all interested in accomplishing. The designation of sizes of wires by actual measurement, either the diameter in thousandths of an inch or sectional area in circular mils is also gaining ground. This practice is open to one objection, owing to the fact that several words are required to accurately express a given size when it is necessary to order by telegraph. To remove this difficulty and also all doubt as to the gauge which a distinct correspondent may use, I propose the following system: That all existing gauges be tabulated in progressive order from the smallest practical size to the largest used; this table to embrace every existing gauge, whether the Birmingham, Standard, American, Washburn & Moen, Edison or Decimal gauge. To each size thus specified let us assign a carefully selected code word of such a character as to be free from liability to telegraphic or caligraphic errors. Such a table prepared for general circulation would permit a single word to indicate any existing size of wire, according to any gauge now in use. Furthermore, the incorporating of such code word in any letter or telegram would indicate that the correspondent recognized the system. Manufacturers and dealers who choose to continue the use of the gauges already adopted by them, would simply select from the complete list such words as applied to the sizes now printed in their catalogues. As a hastily prepared example of the proposed system, I respectfully submit the following brief table:

No. 20 American—Apple.
No. 20 Birmingham—Banquet.
No. 20 Standard—Salad.
No. 20 Washburn & Moen—Wagon.
1,000 circular mils—Mammoth.
32-1000 of an inch—Truthful.

A similar code is in use by manufacturers of iron pipe for the exact specification of sizes and qualities which would otherwise require extended description, with consequent liability to error. It will at once be seen that such a plan does not contemplate the introduction of an additional gauge, or conflict with the use of those already existing, but is a simple method by which the prevailing annoyance may be gradually eliminated, without interference, in the slightest degree, with the existing custom.

MR. LOCKWOOD—Although I think the discussion has gone almost far enough, I cannot forbear saying that I like that idea very much. The only objection which occurs to me is the chance it would give the telegraph operator to get in his work. I have been a telegraph operator myself, and I recollect on one occasion I received a message from St. Louis, which was signed with the inexplicable signature of A. P. Pleton, No, Yes & Co. The word "Apple" called to my remembrance the incident. I called back to ask if that address was correct, and the repeating office said it was. I sent the message out, and the party who received it said they knew no firm of that name, and wasn't it Appleton, Noyes & Company? And it was.

THE PRESIDENT—Is there any further discussion on this subject? Does the Association wish to take any action on this question of gauges? If not, we will proceed to the regular order of business.

The Chair forgot to extend the thanks of the meeting to Mr. Garratt for his very able discourse. He will please accept the thanks of the Association.

The Executive Committee desire to report that in accordance with the duty devolved upon them by the Constitution, to appoint a Secretary of the Association to serve during the ensuing year, they have re-elected our worthy and efficient Secretary, General C. H. Barney, at the usual salary.

The next paper before the meeting, according to the order of the day, is a paper on Underground Work, by W. D. Sargent, of Brooklyn.

Mr. Sargent then read the following paper:

UNDERGROUND WORK.

In my remarks on underground work last year the style of our creosoted wooden conduit was fully described.

In the latter part of December, 1886, in consequence of the passage of an amendment to an existing ordinance by the Board of Aldermen, the Commissioner of City Works refused to issue permits for opening the streets. For this reason our underground work has been at a standstill. We had submitted plans for 1887 for six miles of creosoted wooden conduit, which were approved by the Subway Commissioners, but for various reasons an application to the courts for a mandamus has been delayed until now, and a decision is expected in the next few days. The Dorsett conduit, five miles in all, connecting Brooklyn and Williamsburgh, when completed, proved to be very defective. The faults in it are due to several causes, but chiefly to carelessness in laying it in the ditch and making the joints. After a great deal of work, occupying all this year, the ducts are now reported ready for occupancy. The Dorsett material is very rough, and at the joints it squeezed through the cracks, making projections that were broken off in the process of clearing out, and brushes had to be run through to clear these pieces out. Even now the ducts are so very rough that a lead cable is badly scratched in hauling in. It was claimed this material was gas-tight and water-tight; our experience is that it is neither gas-tight, water-tight, or even mud-tight, all of these things having been found in the ducts and man-holes. The only explosion of gas we have had in Brooklyn was in a Dorsett man-hole. Recently the elevated railroad people exposed about eight feet of the first creosoted wooden conduit we laid three years ago. There is not the slightest decay externally, and the ducts inside are clean and dry, the friction rollers running as smoothly as when first laid. Looking backwards, we feel that, had we to do the work over again, we should enlarge the ducts to 3 x 3 inches inside, and double or treble their number, because we now see that, with increased diameter necessary in cables and the use of double conductors, our space will soon be exhausted.

We had expected to be able to lay six miles of conduit this year, which would make a total of 20 miles. This work was prevented by the conflict of authority between the Subway Commissioners and the Board of Aldermen. No change has been make in our plans for distributing, and we expect to do this from terminal poles and housetop fixtures. In the business portion of the town we are able to secure places for fixtures without much trouble; but amongst residences it is very difficult. We have carried the cables to housetop fixtures in one case by going through the cellar to the rear of the building, then up the wall to the fixture on the roof. We have a cable box in the cellar and run all wires in use for that building from there. In two other cases we have run a galvanized iron pipe up the face of the building alongside the water spout, and through this carry the cables to the fixtures for distribution.

We are in communication with the elevated railroad people for the purpose of carrying cables and wires on their structure for distributing purposes. No terms have been made yet.

The Brooks' cables, covered with pure lead, have now been in service three years. The corrosion of the lead pipe noted last year is still going on, with indications that it will take several years more to reach the insulated wires. The Western Electric cables, lead with a small percentage of tin, placed in the same conduit at the same time, show only a thin, hard, white scale, with no indications that it is increasing. The New York and New Jersey cables, covered with lead and tin, have been in the conduit about nine months, and they show no corrosion beyond a thin scale. I think we may assume that a composition of lead and tin resists the action of the gases in underground conduits. We now have eighteen cables aggregating 1,700 conductors leading out underground from our Brooklyn central office ; 939 of these conductors are in actual service. Six cables, aggregating 500 wires, leading out from the Bedford office—175 of these conductors are in actual service.

We have, all told, 16 miles of cables underground, 1,500 miles of conductors, 900 miles of which are in actual service.

The cables leading out from Brooklyn central office range from 900 to 7,180 feet ; in Bedford, from 460 feet to 2,250 feet.

The first cables furnished by the Western Electric Company, 100 wires mixed indiscriminately, have been in service since November, 1884, and have given satisfactory service, with one intermission, on account of defective terminals. This difficulty seems to have been solved by their last devices for that purpose, and no serious decline in the insulation has occurred for the past two years.

The wire used in all our present cables is .035 to .038 inch diameter, with insulation .075 to .088 inch.

Realizing that metallic circuits will be necessary in underground work, all our cables were ordered twisted in pairs or groups of four. Through a misunderstanding a portion of the cables were furnished indiscriminately.

We now have cables with the conductors related to each other in three different ways.

It was found at once that the cross-talk between two of a pair, or two of four, was too great for satisfactory service. There is no cross-talk between the pairs or the groups of four.

One cable of 7,180 feet, 100 wires twisted indiscriminately, of the Western Electric manufacture, has some cross-talk, but not enough to prevent its use, and 84 of the 100 wires are in active service. The insulation of the cable varies from 650 to 450 megohms in summer, and the capacity is .227 microfarads per mile.

The next in length was made by the New York and New Jersey Telephone Company, 6,660 feet, with 100 wires twisted in pairs. The cross-talk between pairs was so bad we were compelled at once to take measures to remedy it. The joints were opened and the pairs broken up at all the man-holes at intervals of about 800 feet. The effect of this work was to reduce the cross-talk between pairs and distribute it among all the wires. It may be expected, of course, that more frequent transpositions would make the cable just as good as the Western Electric. This is not practical, and we shall restore the wires to their original relations, grounding the twin wire until the metallic circuit era

arrives. The insulation of this cable ranges from 54 to 29 megohms per mile, and the capacity is .3 microfarads per mile. Thirty subscribers are working through it.

The shorter cables give similar results, diminishing proportionately to the length.

To connect our Brooklyn central with branches at Bedford and Williamsburgh will require 2½ to 3 miles of cable, and we believe, if we followed the Western Electric type there would be enough cross-talk to make them valueless, or if we ground the twin wire in the N. Y. & N. J. type we believe there will be retardation enough to make serious trouble. We have therefore decided to make our long trunk lines of copper .050 in diameter and insulation .125 in diameter. This reduces the copper resistance nearly one-half and increases the thickness of the insulation. Sixty wires of this size may be put in 1⅛-inch core, making a cable with an outside diameter of 1½ inches. We are restricted to this size by the 2-inch holes in the Dorsett conduit.

Owing to the delays caused by the action of the Board of Aldermen, none of this cable has been made up to show what its electrical qualities will be.

The insulation of the Western Electric cables quoted shows there has been no reduction since the last terminals were put in. The New York and New Jersey cables do show loss of insulation, but we attribute this to the joints and terminals, our men lacking skill and experience. Time will improve this, and, other things being equal, we believe both cables will give good results.

We believe it economical and desirable to have employees capable of doing all kinds of cable work, including joints and terminals, and have two men under instruction for that purpose.

A 25-wire Okonite cable was drawn into the creosoted wooden ducts in the summer of 1885 and remained there in constant use until this summer. when it was removed to make room for more wires. There is no sign of deterioration or decay in the rubber, and the insulation is 150 megohms per mile in water since it was taken out of the conduit.

It is generally believed that rubber cables will be damaged or destroyed by laying in cresoted wooden ducts, unless protected by lead. It would be interesting to make further trials to demonstrate whether this be so. For terminal wires leading from the conduit to the building some form of rubber or gutta percha wire is the most convenient.

We expect to remove our Brooklyn central office to a new building as soon as we can get permits to open the streets. All our wires will be brought into this building underground. The new office will be equipped with the latest improvements in multiple boards, including metallic circuits.

MR. SARGENT—I have received the following paper from Chicago and letters from Boston relating to the results of the underground work in those cities.

Mr. Sargent then read the following paper, written by Mr. B. E. Sunny, of Chicago:

CHICAGO UNDERGROUND AND AERIAL CABLES.

A mile of Patterson cables has been put down in West Madison street, made up of one 150 wire cable, and cables of from 25 to 125 conductors, containing in all about 200 miles of wire. No. 18 American gauge was used, and the insulation and capacity tests are very satisfactory.

These cables were put down to abandon a pole line of 90 wires built about six years ago. Notwithstanding the fact that the wires on the route were badly decayed and contained many defective connections, and that the cables were of the best manufacture, the wires on the pole route talked about twenty-five per cent. better than those in the cables.

The cross-talk is only noticeable at times, and is not heavy. These cables are laid in a box of creosoted wood, and covered with one-fourth inch tarred sheet iron. The box is just big enough to take the cable, and no filling of any kind is used. A gang of twenty men put this cable down at a rate of 500 feet per day, finishing up everything excepting the permanent restoration of the pavement. 1,100 feet of conduit has been built to carry the cables from the present central office to the new building. The construction includes the use of wrought iron pipe 2½ inches inside diameter, free from burs, and presenting a smooth surface to cables. The pipes, sixteen of them in all, are spread apart, and the interstices filled with concrete.

We are pulling No. 18 gauge 200 conductor cables into the pipes, and find that they work smoothly, and that a gang of six men can pull in four pieces of cable, 400 foot each per day. The underground cables put down two years ago are giving satisfaction. Recent tests on some of them show an insulation, ranging from five to fifteen megohms. One cable put down by the Standard Company two years ago indicated a very low insulation on the regular test. We opened the street in two or three places, and finally located the fault in a splice. No abrasion of the lead pipe could be noticed, nor was there any superficial evidence of a fault. A piece including the splice was cut out, and another piece of cable put in. The piece cut out was laid on a board, and shortly it was noticed that water was coming out of the splice through a blow hole, the size of a pin in the solder. There was, perhaps, half a pint of water in the sleeve. It took two years for the fault to develop. In another instance a Standard cable was cut into by plumbers some time last November. In June the insulation was found to be low, and when the fault was located, it was discovered that the water had gone into the core through a bad cut in the lead, and had worked back forty feet, requiring new cable to that extent. We have several cables, chiefly aerial, that are defective, and are being looked up. It requires the constant attention of a galvanometer corps to keep them in good shape. By means of semi-annual tests, defects have been discovered and removed before they have had time to effect the service. The trouble from low insulation at the terminals is being overcome by filling the terminals with paraffine wax or some other insulator, and keeping the terminals well protected from moisture. The trouble outside of the terminals on air cables is made up of cuts in the lead by hooks cutting through, bullet holes and careless workmen.

The following tests recently made may be of interest. Two wires were selected which ran together through nine cables of seven different styles, a dis-

tance of 4.4 miles. The cables are Patterson aerial and underground and Standard aerial and underground, and contain from fifty to one hundred and fifty wires each, ranging from 18 to 26 gauge. The resistance measures 444 ohms.

The first test was made on a day of alternate sunshine and rain, when everything was damp, There was absolutely no cross-talk from one wire to the other, and conversation could be carried on freely and without any more effort than on an air line. The introduction of an annunciator drop into the circuit made no difference. A test for insulation showed 400,000 ohms for the distance, and a static capacity of 1.4 microfarads. A week later the same wires were used in the same manner with less satisfactory results. The weather was dry and warm. It was found that counting on one could be distinctly followed on the other, and *vice versa*. The cross-talk from the other wires was very noticeable, but not of sufficient volume to disturb the user. Conversation at a distance of eight inches from a fairly adjusted transmitter was indistinct and muffled. With the lips close to the transmitter, and by speaking in the usual tone of voice, the results were fairly satisfactory. This is particularly true when an air line of one and one half miles was added. The measurements made after the test showed the insulation to be four meghoms for the distance against .4 of a meghom on the previous test, and 1.05 microfarads capacity against 1.4. By opening one of the wires at both ends, so that all connection with the earth was removed, conversation could be freely carried on between three parties who were looped in. The first one was 5,000 feet from the open end of the cable, and the other 12,000 feet. The only difference noted by the intermediate parties in the working of the wires with the ends open was that the cross-talk was much heavier than with the grounds on. The second test indicates conclusively that we have used up all of our margin, and that a slight addition to the length of the cables will make the connection of no commercial value. In fact, in ordinary dry, clear weather, conversation is only carried on by frequent repetitions and considerable discomfort.

The nine cables included in this test are all in good condition, and with the exception of a few pieces of air cable are new. On the above circuit there are sixteen terminals in use, but in all cases except in exchange offices the cable wires of one cable were connected with those of another at the terminals with Kerite or Okonite wire, so that the insulation was good at these points. The experience of four years has proven the fallacy of the practice of requiring the manufacturers to furnish a cable showing an insulation of from 300 to 800 megohms per mile. While this insulation can be secured immediately upon the completion of a cable, it is utterly impossible to maintain it. Nor is it desirable to maintain it, for the reason that cross-talk is greater on a cable with a "fancy" insulation than in one of a megohm. Subscribers always complain of cross-talk when their wires are put into a new cable, but after a few months we hear no more about it. This is not so much because they have become accustomed to the cross talk as it is that with the lowering of the insulation the cross-talk is decreased. A better specification would be one megohm per mile, and not more than five, and a guarantee from the manufacturer that this insulation will hold up for ten years. Such an insulation exceeds anything that we are able to get on air lines. In a recent test nine wires showed each an insula-

tion of 5.3 megohms. Rain began to fall, and in ten minutes the insulation had fallen off to 3.2, and no doubt went lower. This illustrates the extreme sensitiveness of a high insulation to moisture, and indicates clearly that where there are a large number of cables in use, the conditions are constantly varying, and nothing like uniformity in the working of the wires can be expected or secured.

Mr. Sargent then read the following letters from W. J. Denver, General Manager of the New England Telephone and Telegraph Company:

BOSTON, September 6, 1887.

W. D. SARGENT, ESQ.,
General Manager New York and New Jersey Telephone Co.,
NEW YORK.

DEAR SIR—Referring to your inquiry about underground conduits for telephone cables in Boston, allow me to state as follows:

In October and November, 1882, we laid 1,157 feet 8 pipe conduit, 710 feet 6 pipe conduit, and 704 feet 4 pipe conduit. The conduits consisting of 3-inch iron pipes, laid in and covered with cement concrete, making for the 8 pipe portion a conduit 2½ feet wide and 1½ feet high.

During the Summer of 1886, 1,400 feet 6 duct conduits, made of creosoted pine were laid down, and later in 1886 5,300 feet 12 duct conduits, 2,760 feet 9 duct conduits—all of creosoted pine. These 9 duct conduits are each 16 feet long and 13 inches square. The tops, bottoms and sides are 2 inches thick, and the inside frame work one inch thick. Each duct is about 2½ inches square. All joints, flaws, etc., are coated with boiling pitch. The joints between sections are covered with two thicknesses of tar paper, with hot pitch underneath, between each thickness and over the outside; on top of the conduits are nailed 2-inch spruce planks, so laid as to break joints. The man-holes are about 500 feet apart, and consist of brick chambers from 3 feet by 4 feet 4 inches to 4 feet 4 inches by 4 feet 4 inches, 7 feet deep, with 8-inch walls covered with stone flagging, upon which rests the iron frame and cover.

In May and June of the present year, 4,280 feet 9 duct creosoted pine conduit was laid down, and later on about 6,000 feet 9 duct conduit of creosoted pine.

Altogether we have now laid down about 22,310 feet of conduit with a capacity for 205,700 feet of cable.

All of the conduits are in use and in good condition.

The following cables have been laid:

4 cables, 100 conductors each, 1,157 feet long.
2 cables, 200 conductors each, 885 feet long.
3 cables, each 100 conductor, 860 feet long.
1 cable, 100 conductors each, 885 feet long.
2 cables, 100 conductors each, 530 feet long.
1 cable, 80 conductors each, 885 feet long.
1 cable, 200 conductors, 670 feet long.

1 cable, 100 conductor, 670 feet long.

1 cable, 80 conductor, 670 feet long.

1 cable, 100 conductor and 1 cable, 80 conductor, 800 feet long.

1 80 conductor and 1 50 conductor each, 1,200 feet long.

1 80 conductor cable, 2,650 feet long, and 2 100 conductors each 1,400 feet long.

Altogether we are working about 24,000 feet of cable underground.

All of the above is Patterson cable and in good order.

One of these cables was laid in February, 1883, and was partially destroyed by electric light trouble on its outside aerial extension, but was cut off and used again, and three others laid at the same time were drawn into one tube. When first laid they were supposed to have been strained, and were abandoned on account of grounding. Later on, however, it appears that the moisture resulted from imperfect jointing at the underground terminals, and upon being cut back to the next man hole they were found to be all right, and have worked satisfactorily ever since.

The Standard cable now used is as follows:

50 conductor No. 18 B. and S. gauge, capacity not more than .20 microfarads per mile, diameter $1\frac{1}{8}$ inches.

100 conductor, No. 18 B. and S. gauge, capacity not more than .17 microfarads per mile, diameter $1\frac{7}{8}$ inches.

Yours truly,

W. J. DENVER,
General Manager.

BOSTON, September 15, 1887.

W. D. SARGENT, ESQ.,
General Manager New York and New Jersey Telephone Co.,
Brooklyn, N. Y.,

DEAR SIR—I have gathered some additional information on cable matter which might be of interest to you.

Our electrician, Mr. Farnham, states that other conditions being the same. he has been unable to detect any difference in talking through Patterson cable, whether underground or over head; the lead pipe contains so much metal in proportion to the conductors, that it gives all the retarding effect possible. Measurements for static capacity seem to confirm this opinion. Difficulty in working cables will come not so much from connections about town as from long air lines connected with cables.

We have had made and laid underground a Patterson cable of 81 conductors, which is the longest length of continuous cable we have, being 6,567 feet long, all under ground.

A description of this cable is as follows.

Total number of conductors, 81; 80 conductors are No. 16 B. and S. guage .505 inch; resistance per mile, 21.8 ohms; resistance per piece, 27.1 ohms; static capacity, .214 microfarads per mile; one conductor No. 20 B. and S. gauge .0319 inch, resistance per mile, 55.2 ohms; resistance per piece, 68.7

ohms; capacity per mile, .177 microfarads. When wires not in use are grounded but little "cross-talk" is noticed.

It seems to be advisable that all cables should be of as low static capacity as possible.

Yours truly,

W. J. DENVER,
General Manager.

After reading the foregoing paper and letters, Mr. Sargent continued:

There is a great want of knowledge among users of cables as to the best forms, size and dimensions necessary to be able to predict with reasonable accuracy what results may be expected from any given length of cable.

The results obtained by the American Telephone and Telegraph Company, in operating long distance communications by means of large copper metallic circuits and improved transmitters has brought into prominence the necessity for a higher degree of efficiency in exchange work. It would seem as though enough experience has been had, if formulated properly, to guide our efforts to higher efficiency. With this end in view, E. J. Hall, Jr., of the American Telegraph and Telephone Company, recently invited a few telephone men living in the neighborhood of New York, to meet at his office for the purpose of discussing the subject of telephone cables, and making an effort to define the qualities that are needed for good work.

Dr. Jaques, electrician of the American Bell Telephone Company, read a very interesting paper on the results obtained on a very large number of lines varying in length, resistance and capacity, and from these results offers a formula for calculating the requirements for good commercial talking to any required distance. His definition of a good line is very good, although I think many exchange lines would be disqualified by his standard. It is, that when two persons not experienced telephone experts are able to carry on a conversation without repeating or at least no more than speaking face to face. He believes that the readiness with which telephone conversation may be carried on depends on: First, the total electrical resistance of the circuit forming the two stations; second,

on the total electro-static capacity of this circuit; that no matter what may be the distance between two points, good business conversation may be carried on between them, provided they be connected by a pole line or cable, or both, the product of whose total resistance by its total capacity is less than 2,000 for Blake transmitters, and 4,500 for the Hunning's transmitters. He claims that by this formula it is possible to write a specification for any line it may be desired to build. This formula applied to several lines leading out of New York city seemed to prove its truth. The specifications for a standard cable meeting all the requirements of telephone work are confined within narrow limits, on account of the necessary multiplicity of wires and lack of space in all large cities. J. P. Davis, consulting manager of the American Bell Telephone Company, states that .125 of an inch is all that can be allowed in New York city for one wire. It was also agreed that the best way of wiring new multiple boards is to make them up for metallic circuits at once, placing one ground, as long as they remain, in the subscriber's office, and the other at the point where the twin wire ends. Realizing the importance of the conclusions arrived at by the conference, the Metropolitan Company has decided to wire its new colossal board in this way, and the new switches for Buffalo and Brooklyn will be wired in the same way. This will place the central office on a loop, which can be completed at any time.

THE PRESIDENT—Gentlemen, you have heard the paper read by Mr. Sargent. What is the pleasure of the Convention in respect thereto? I presume we will follow the usual course in such cases?

MR. GIFFORD—I move that the Association return a vote of thanks to Mr. Sargent for his very instructive and suggestive paper.

MR. PHILLIPS—I heartily second the motion.

The motion was carried.

MR. BAILEY—I would be glad if Mr. Sargent or some of the other gentlemen who are familiar with the work would describe to us the process by which Patterson cables are

spliced; that is, particularly the splicing of the old pipe in a manner to prevent damage to the insulation. I think it is a little difficult for one to do, if not acquainted with it.

THE PRESIDENT—I see we have among us Mr. W. R. Patterson, who is probably as competent as any one person to give you a full description of the method of making a joint. Mr. Patterson, Mr. Bailey desires to know what is done, and how it is done, in the making of a joint of a lead pipe in order to prevent the insulation from being injured. Will you favor the Association with your views?

MR. PATTERSON—The first thing, and about the only thing to look out for, in making a joint in a lead covered cable, is to keep out moisture. The ends of the cable, after the cable is made, should always be sorted out. Then, after the cable is drawn into a conduit, the end of the pipe is cut off and the pipe removed from the core for a distance back, corresponding to the size of the cable. For 100 wire cable we would want to strip about 18 or 24 inches on each end. On the new style of cables, arranged for metallic circuits, each pair of conductors are twisted together, and served with a single splint of cotton. The serving around the two wires will hold them in place until the man who is doing the splicing deliberately removes it. One is covered with white cotton and one with red and white, or some color that can be easily distinguished. The two wires are brought together, and the way we generally make a splice, and the best way I think, is to strip the wire for an inch and a half, bring them together, and instead of making a long splice, bend them up and then twist the ends together. That will leave the wire running through and the two ends twisted together standing at right angles. A cotton sleeve is drawn over it. This sleeve is like the outer braiding of office wire. It is simply cotton braid around a hole, so to speak. After all the wires are spliced in that way they should receive a bath in very hot paraffine, poured on while they are laid out loosely, to remove moisture which they may gather from the atmosphere and from the hands of the men. Then the core should be covered and

brought down to a compact size, so that the lead sleeve will slip back over it. After that sleeve is on, it should receive another paraffine bath. After the work is all done, it is well to take a torch or something of the kind and pass it along underneath the cable and melt the insulation for a distance of one or two feet each side, so as to put on a pressure and test the joints, and if there is any flaw it will show itself by the paraffine oozing when the pressure is put on. That is the way we make straight sleeve splicing. But occasionally in underground work it is not convenient to make a sleeve splice; there may not be room to work or there may be an escape of gas. In that case we turn both ends of the cable up and bring them through the top and have a brass casting in the form of an inverted Y. The two branches of the Y are of such size that the cable pipe will slip into them, and the main outlet is large enough to make the splice. The wires are brought up through there and spliced together similar to a straight splice and the opening covered by a cap, either an ordinary pipe thread screwed in, or if it is larger, by a flange and bolster on the outside. After the work is done that Y is dropped down into the hole. That removes the necessity of doing the work in the manhole. The Y is lifted up to the level of the street and the man sits on the edge, with his feet inside, and works on it, and is not obliged to go down into the gas. I think that covers about the ordinary process of making splices, as we do it.

MR. BAILEY—What I had reference to was whether there was danger of injuring the insulation by the heat applied in making the wiped joints.

MR. PATTERSON—No, sir; there is not. The heat is only for a few moments. If it was continued at that temperature for half a day or a day or two it would injure it, but it is only for five or ten minutes, and in that time it cannot injure anything.

MR. SEELEY—I would like to state that in New York city the Metropolitan Company have something like eighteen miles of underground cable. It consists of three different systems—the Edison, the Brooks and the Western Electric.

We have nine miles of the Western Electric in Sixth avenue. The longest length is two miles. This gives us entire satisfaction. We have had one explosion with the Dorsett system. The conduit is very rough, scratching all the lead pipe from the cables when they are pulled through. Mr. Hall is working one of those cables a distance of about two miles. We have no trouble in making our underground joints; we let the Western Electric do that for us. But with our aerial cables we have a plumber who makes those joints as Mr. Patterson has described. The only difficulty we have had, with any underground system, has been with the Brooks system. A short while ago 400 wires failed. We traced it down to the terminals, where there was some water. We were compelled to draw the cable out and boil it. After putting it back again the cable worked better. Our insulation ranges from 500 megohms to 1 megohm. The Brooks system measured very much lower than that. The longest length of the Brooks is 1,900 feet. The static capacity ranges from .12 to .13 microfarads, and on moderate insulation, say 1 megohm per mile.

THE PRESIDENT—What is the result of your investigation in regard to the Brooks' cable as to cross-talk? Mr. Brooks says that his cable is absolutely free from cross-talk.

MR. SEELEY—I beg to differ from Mr. Brooks on that point. There is some cross-talk in Brooks' cable. I never saw a cable yet but that there was some leakage or cross-talk. We are compelled to ground all the wires that are not in use. Of course that cuts down the cross-talk considerably; but there is a slight leakage. Probably if we prolonged the Brooks system a mile and a half or two miles we might find what the effect would be. I don't think we could talk through it two miles. The static capacity of the Brooks system at the present time is .12 to .13 of a microfarad per mile. I would like Mr. Brooks to go there and measure, or have some experts measure it. I would also like to state that Mr. Theodore N. Vail, the President of our company, has decided to use metallic circuits in the future for all our subscribers. Our cables will consist of a No. 18 Brown &

Sharpe gauge with a static capacity of .20 of a microfarad. I presume the Western Electric will make the cables. They are to be twisted in long twists. Instead of putting 100 single wires in a cable we are going to put 100 metallic circuits in a cable. The metallic circuits will not be brought into use at the present time; but as the subscribers' lines are gradually turned into metallic circuits we will use the wires, and we will ground one side of the circuit until that time occurs. We have cables in New York city, made of No. 14, No. 16 and No. 18 wire, American gauge. We talk as well on a No. 18 wire as we do on a No. 14. We have no underground cables under 20. We have 20 miles Patterson aerial cable that is of No. 20 and No. 26 wire. We also have some long kerite cables, static capacity, ranging from .25 to .30 of microfarad. We have a cable running from our Brooklyn testing-house to Mr. Sargent's exchange in Brooklyn, which has been there some sixteen months—a Patterson cable. I think that is a No. 14 cable. They are grounded circuits. Our original intention was to use them as metallic circuits at some future day. That cable gives us entire satisfaction. I have not noticed any corrosion of the pipe there.

MR. SARGENT—That cable at the Brooklyn office is grouped in fours; but are not those groups broken up at all joints?

MR. SEELEY—Yes, I regret to say that they are.

MR. SARGENT—Our experience is that unless that is done, parties talking on any two of a group of four will have very serious trouble from cross-talk.

MR. HALL, JR.—I would like to correct one statement that Mr. Seeley made—that we were using one of the Patterson cables with entire satisfaction. It is true that the cable works very satisfactorily, but the statement wants some qualification. There are very few conductors in use in the cable with metallic circuits, and as conductors are being added from day to day, we are finding an increase of interference from cross-talk. It has increased to such an extent that I have no idea that the cable as it is laid up will be at all satisfac-

tory to us when the conductors are all in use. On the contrary, I think that any cable which is laid up for grounded circuits will not be at all available for use for metallic circuits. The conclusion that we reached in our discussion in New York on this subject was that with the increased length of cables which were coming into use in all the exchanges, in a very short time the grounded circuits would have to be abandoned; that the interference between wires would be so great that we could only get satisfactory service, local as well as for through lines, by the use of metallic circuits. If that conclusion be accepted generally we have practically no cables in use to-day in the telephone exchanges which are properly adapted for converting into metallic circuit cable. I think that point should be made very prominent, and that in our future arrangements for cables we should consider the question as to whether those cables must not inevitably in time be used as metallic circuits. In that case they should be planned at the outset for that use. There has been a general impression that we might, after awhile, take out these cables, open up the joints and rearrange the connections so as to adopt the present grounded circuits for metallic circuit use. But a little reflection will satisfy any one that that is not possible, when you come to think of the complications involved in doing any work on cables underground and then imagine a conduit filled with lead cables. The proposition that those cables can be opened at all the joints, the wires re-connected and the circuits maintained at the same time, will strike anyone as something that is not feasible. We cannot go on working the present grounded circuit arrangements with the idea that we can after awhile convert them into a metallic circuit system. It is a mechanical impossibility.

MR. SEELEY—I did not mean to state that Mr. Hall is working with entire satisfaction. But if he is not I never knew it before. He is working metallic circuits through a cable, and we are working ground circuits through the same cable. Therefore he must have more or less induction. Probably, if the entire cable was metallic circuits he would not be affected by induction.

MR. HALL, JR.—On the contrary, Mr. President, we would be more seriously affected by induction.

THE PRESIDENT—Where does this cable run to and from?

MR. HALL, JR.—It is a cable running through the Sixth avenue conduit, New York, about two miles. We tried the experiment, practically, of working a cable two miles and a quarter long, which is giving good results when used for grounded circuits. As a metallic circuit cable the line worked so badly that we asked Mr. Eckert to take the conductors out of the cable and give us some overhead wires, which he did, and the trouble was at once removed. The difficulty was simply this; in working a grounded circuit through a cable—worked indiscriminately—two miles and a quarter long, you have two and a quarter miles of exposure of the conductor to interference from other wires. When you bring the return conductor back through that cable you have four miles and a half of exposure to induction from single wires, for the reason that the wires in the metallic circuit are not affected equally by the disturbance. They are not parallel, and they are not laid up with reference to the other wires in the cable. You start in at one end with No. 1 and No. 2 wires immediately adjoining, but at the first joint the wires have been taken up, so that they do not continue in that parallel relation at all, but one wire may be at one side of the cable and the other wire at the other side. So that you practically get in the cable just what has been talked of before in our Conventions—a metallic circuit which has not a return wire parallel with the outgoing wire, but you have a wire which runs out one way, makes the circuit and comes back another way. You all know that on an aerial circuit arranged in that way, instead of getting rid of the disturbance from induction, you will double the disturbance, provided the amount of disturbance at all parts of the line was doubled.

MR. LOCKWOOD—While not specially germane to the subject, yet, taken in connection with the subject we were discussing previously, I think it is perhaps proper to call to the attention of Mr. Sargent that the gentleman from

Brooklyn, in his paper on "Underground Wires," referred to the sizes of his wires in thousandths of an inch, and that he neglected to designate sizes according to the gauge which Mr. Sargent is the only one who consistently holds to. I am sure that Mr. Sargent will thank me for calling his attention to the conduct of the gentleman from Brooklyn.

MR. SARGENT—Mr. Sargent is perfectly willing to emulate Mr. Lockwood, instead of Mr. Gladstone, and has backed down from his advocacy of the standard wire gauge.

MR. BENNETT—I have listened to the discussion here with a great deal of interest, and I have come to the conclusion that the underground work in New York is not satisfactory, either to the mechanics or to the subscribers. If I am wrong I wish to be set right.

MR. SEELEY—The present condition of our underground cables is of course not satisfactory. If it was we would not go to the enormous expense of giving every subscriber a metallic circuit. We have more electric lights, more telegraph companies, more motor companies and all kinds of induction in New York than anywhere else. Induction does not come from the underground cables. It is brought into the cables from the overhead wires. Therefore that is why I would like the problem to be thoroughly discussed here. If you gentlemen are having any trouble with your underground cables in other cities we would like to know it.

MR. BENNETT—What I asked for was simply that those gentlemen who had had experience with underground cables would recommend to us country members something to adopt.

MR. SEELEY—I think Mr. Sargent's paper recommends a cable.

THE PRESIDENT—Gentlemen, if there is no further discussion——

MR. HALL, JR.—I would like to make one statement further, which I think would be of interest. We all had in mind the fear that cables could not be worked to any great extent in connection with a Telephone Exchange, and it was thought that the limit of distance at which they could be

operated would be very short. We recently worked a line between Philadelphia and New Haven, about 175 miles, in which there were eighteen miles of cable, that cable being made up of aerial, underground and submarine; fifteen miles of that was continuous in one stretch. That worked on metallic circuit. The plant operated with entire satisfaction. So I do not think we need fear that in any of our cities we will strike a limit over which we cannot talk successfully even although we use cables entirely.

MR. BENNETT—Was that an experimental test?

MR. HALL, JR.—Yes, sir.

MR. BENNETT—It has not been practically tested by subscribers, has it?

MR. HALL, JR.—The cables were connected up for the purpose of making this test.

MR. BENNETT—What will be the practical result when you have fifty subscribers in a 100 conductor cable, all connected by metallic circuits?

MR. HALL, JR.—It will work just exactly as well, if the cables are constructed with reference to using metallic circuits.

MR. BENNETT—But they have *not* worked heretofore. Are you not giving us theory?

MR. HALL, JR.—No, sir; it is practice.

MR. BENNETT—It is only practice by one person.

MR. HALL, JR.—I do not know anywhere else where you can get 18 miles of metallic circuit cable in a shape to make experiments.

MR. BENNETT—I understood the President to say yesterday in conversation, that he had a seven mile cable that did not work satisfactorily.

MR. SEELEY—You are speaking of metallic circuits, aren't you, Mr. Hall?

MR. HALL, JR.—Yes, sir.

MR. BENNETT—I asked the question, can you work with fifty subscribers in a 100 wire cable? Is it practical for exchange purposes?

MR. SEELEY—I think it is. They do it in Paris. They work twelve miles.

MR. BENNETT—In Paris they have got large sewers to run the cables in, haven't they?

MR. SEELEY—Yes, sir.

MR. BENNETT—I do not understand that there are any large sewers in Hartford or in New York.

MR. SEELEY—We have large sewers in New York; they are building them for us—underground conduits.

MR. BENNETT—I simply ask these questions for practical information; that is all. Theory is very good. Theory for you and me to go out and take a drink is first rate if we do not do it; but when we come to practical experience in telephone exchanges it is not worth anything.

THE PRESIDENT—I am afraid if the gentleman should ask the Chair to go out and take a drink that it would be put into practice.

MR. BENNETT—Last year we heard how nicely these underground wires worked. Everything radiates from New York. Everything radiates throughout all our exchanges, in this underground matter, from New York. Now, I wish New York to perfect her service so that gentlemen who are managing corporations in that city can come here and explain it to us. The company that I represent to-day have got Dorsett in three cities. I am told that Dorsett's conduits are melting down in New York. I am told that in Chicago they have got to take a long pole with a torch on one end and put it into the conduit so as to see whether it would be safe for a man to go in. Mr. Sargent says that gas and water collect in this system, and it isn't good for anything. The gentlemen laugh. I noticed that you gentlemen when you first commenced to put up poles put up six inch ones to carry 100 wires for overhead work. The men who are putting their money in telephone stock want to get the best possible appliances they can get for their money, to continue the business practically. As I said before, theory is very nice. Two years ago there was not anybody talking metallic circuits. You now come here and state to this Convention that you have got so many miles of wire. You have got a subscriber say 100 feet from your exchange. You tell

us he is on a metallic circuit. That is 200 feet of underground work for that one subscriber. Why not simply say that you have so many subscribers and it takes so many miles of wire for those subscribers?

MR. SEELEY—I stated emphatically what our cables were in miles—eighteen miles of underground cables—not wire. Longest length, two miles; shortest length, 1,900 feet.

MR. BENNETT—How many subscribers have you on these wires?

MR. SEELEY—3,000.

MR. BENNETT—How many wires in a cable?

MR. SEELEY—From 100 to 400.

MR. BENNETT—How many wires for the 3,000 subscribers?

MR. SEELEY—3,000 wires.

THE PRESIDENT—I understand that Mr. Lockwood has a paper written, I believe, by an electrician of this city. I believe the Convention will be benefited and pleased by having it read. Mr. Lockwood, will you favor the Convention by the reading of this paper?

MR. LOCKWOOD—Mr. President and gentlemen: Before reading this paper I desire to disclaim any connection with the authorship of it. While traversing the purlieus of this city, under the able guidance of our President, I was introduced to a professor, who stated that he had been making investigations of telephonic circuits, and particularly within reference to underground work. It may be that the inquiries of Mr. Bennett will be answered sufficiently by the views contained in this essay. But at all events I shall read it and endeavor to do justice to it. It was handed to me, I suppose, because, coming from a professor it may have been thought that the matter was so heavy that it needed a lightweight to read it. I think I heard General Barney suggest that.

Mr. Lockwood then read the following paper:

"A Dissertation on the Underground Telephone System, its Evils and How to Overcome Them," by the eminent electrician, Prof. Foster, author of "How to Kill Induction Without Killing the Subscriber;" "What I Don't Know About the Future of the Telephone," and other celebrated works.

All systems of underground telephony at present in vogue are subject, more or less (generally more), to outside influences; but the principal difficulty we observe in massing a large number of conductors in one lead shield, is, first, a high amount of infernal resistance plus the scarcity of leakages, causing a residuum of electricity; this would not be so objectionable were it not for the fact that the inductive capacity of the conductors is thereby increased, and can only be overcome by an elaborate use of earth connections, at proper intervals, which, it will readily be understood, carries off any higher charge of electromotive force and everything else with it.

On the other hand, the more we attempt to decrease the inductive qualities of the conductors gathered in a compact body, the greater the depreciation of the conductive force of the several conductors. It is said, "In union there is strength," but in this case it is the extreme reverse. Our experience leads us to believe that where there is a superfluity of earth connections, the undulatory waves do not flow with that freedom for which we could wish; they may enter the cable, but they experience difficulty in emerging therefrom, and as they ooze out, they are very indistinct and highly inaudible. Thus it can be ascertained that while all unnecessary sounds are abrogated, the effectiveness of the conductor itself is seriously affected not only weakening the carrying capacity of the conductor, but also the vocal organs of those who attempt sufficient undulatory motions upon the diaphragms, against which they are exercising their respiratory powers, expecting the vibrations thus produced to transmit through the sluggish action possessed by the conductors referred to—the verbosity of the person and his perspiration increase in the same ratio as does also the retardation of the static capacity which declares that the strong adjectives of the person above mentioned shall have no effect on it, it will perform its duty. Here is a beautiful exemplification of faithfulness to duty that is worthy of emulation. We can picture the misery of the person in his vain endeavors to produce sufficient vibrations to cause a desirable effect upon the auricular organ of the unfortunate party at the other extreme, who is striving with great difficulty to insert the profile of his physiognomy into the mouth-piece of the telephone.

The invention of Mr. Metzger for the relief of the condensive capacity, and its effects upon the same, has not yet been fully demonstrated, but it is intended by this great discovery to shovel this condensive power of the cable into the earth, which will relieve the conductors of this onerous duty, and permit it to act for the purpose for which it was originally created. It has been suggested that part of this extraneous influence may be eliminated by the use of pulverized relays and by the introduction of a greater sectional area of insulation, in proportion to the length of the electrical conduit, but as this is, on account of its attendant expense entirely out of consideration, we will have to resort to other and cheaper means to overcome this alarming difficulty. You will find attached to every first-class Telephone Exchange a contingent of gentlemen, classed as electrical engineers or inspectors, their chief characteristic being a total disregard for the truth, and an unlimited amount of nerve. Without these distinguishing features no one can do justice to his employers or the profession which he honors; these men, by their peculiar and sometimes questionable methods, have raised the underground system to that popularity it now enjoys. One who knows his

business can convince a party who has contracted pnuemonia by attempting to talk on a cable line three miles long, that it is the best wire in the city; on other occasions it has been found necessary to assure the subscriber that his telephone is no good, change the magneto bell, call him up from another, and, by a careful and proper use of language, convince him that everything is entirely satisfactory; this latter plan has been found in every instance to work admirably, and we cheerfully commend it to all who are having, or expect to have, trouble with their underground systems.

[NOTE.—It is understood that this paper was originally prepared and read before an electrical society composed of the inspectors and linemen of the Pittsburgh Telephone Exchange, the author being a lineman in the employ of the Central District and Printing Telegraph Company.—SECRETARY.]

MR. EASTABROOK—I move that the intellectual explosion of the honorable professor be received and placed on file.

The motion was carried.

THE PRESIDENT—Is there any other business before the Convention? If not, a motion to adjourn will be in order.

On motion of Mr. Gifford, the meeting adjourned *sine die*.

C. H. BARNEY,
Secretary.

The next meeting of the Association will be held in New York city, at a date to be hereafter fixed by the Executive Committee.

APPENDIX A.

THE RIVER EXCURSION,

On Tuesday afternoon, September 27, 1887.

The following account of this enjoyable affair is taken from the *Electrical Review :*

The river excursion given by the Central District and Printing Telegraph Company, on board the commodious steamer Mayflower, was the most enjoyable event of the Convention ; in fact, the telephone delegates were never treated more handsomely. The entire Convention participated and devoted Tuesday afternoon to unalloyed entertainment. The objective point was the Edgar Thompson Steel Works (Carnegie Bros. & Co., Limited) at Braddock, Pa., where the party disembarked and witnessed the interesting operation of making steel rails. On the return, Vice-President Sargent took the Chair, and, on motion of Morris F. Tyler, in a brilliant little speech, a vote of thanks to President Henry Metzger for his superb entertainment was adopted, with three cheers. A fine band of music enlivened the occasion, and an elegant collation, with the best of wines, made happy all the hungry and thirsty. The return to Pittsburgh was made particularly entertaining on account of the brilliant picture the large manufactories of that city presented. At 7 P. M. the boat reached the wharf, and the majority of the delegates left the city on the night trains.

APPENDIX B.

OFFICERS FOR THE YEAR 1887–1888.

President.

HENRY METZGER, - - - - Pittsburgh, Pa.

Vice-President.

WM. D. SARGENT, - - - - Brooklyn, N. Y.

Secretary.

C. H. BARNEY, - - - - New York, N. Y.

Treasurer.

H. L. STORKE, - - - - New York, N. Y.

Advisory Committee.

For three years—EDWARD J. HALL, JR., New York, N.Y.
For two years—H. N. GIFFORD, Louisville, Ky.
For one year—MORRIS F. TYLER, New Haven, Conn.

Executive Committee.

HENRY METZGER, *Ex-Officio*, - - Chicago, Ills.
R. M. BAILEY, - - - - Williamsport, Pa.
GEO. N. STONE, - - - - - Cincinnati, O.
J. W. BENNETT, - - - - - Lowell, Mass.
SAMUEL M. BRYAN, - - - Washington, D. C.

APPENDIX C.

ROLL OF ACTIVE MEMBERS.

SEPTEMBER 28, 1887.

American Telephone & Telegraph Co., New York City.
Bell Telephone Co., of Buffalo, Buffalo, N. Y.
Bell Telephone Co., of Missouri, St. Louis, Mo.
Bell Telephone Co., of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Central Union Telephone Co., Chicago, Ills.
Chicago Telephone Co., Chicago, Ills.
City & Suburban Telegraph Association, Cincinnati, O.
Colorado Telephone Co., Denver, Col.
Cumberland Telephone & Telegraph Co., Nashville, Tenn.
Chesapeake & Potomac Telephone Co., Washington, D.C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
East Tennessee Telephone Co., Nashville, Tenn.
Empire State Telephone & Telegraph Co., Auburn, N. Y.
Erie Telephone & Telegraph Co., Lowell, Mass.
Great Southern Telephone & Telegraph Co., New Orleans, La.
Hudson River Telephone Co., New York City.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City, Mo.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.
New York & New Jersey Telephone Co., Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York City.

New England Telephone & Telegraph Co., Boston, Mass.
Ohio Valley Telephone Co., Louisville, Ky.
Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburgh, Pa.
Rocky Mountain Bell Telephone Co., Salt Lake City, Utah.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven, Conn.
Sunset Telephone-Telegraph Co., San Francisco, Cal.
Wisconsin Telephone Co., Milwaukee, Wis.

ASSOCIATE MEMBERS.

American Electrical Works, Providence, R. I.
Hotchkiss, Clark B., New York City.
J. A. Roebling's Son's Co., New York City.
Standard Electrical Works, Cincinnati, O.
Western Electric Co., Chicago, Ill.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Washington, D. C.
Bell Telephone Co., Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, George L., New York City.
Bailey, C. E. Havana, Cuba.
Berthon, A. F., Paris, France.
Callender Insulating and Water-proofing Co., New York City.
Childs, W. A., New York City.
Cheever, Charles A., New York City.
Cassidy, John, Honolulu.
Clark Insulated Electric Wire Co.. Philadelphia, Pa.
Dana, P. H. ,New York City.
Day, A. G., New York City.
Electrical Supply Co., New York City.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington, D. C.

Madden, O. E., New York City.
Phillips, George L., Chicago, Ills.
Phillips, E. F., Providence, R. I.
Potter, F. I., Pittsfield, Mass.
Pope. H. W., New York City.
Sawyer, W. H., Providence.
See, I. W., Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., New York City.
Williams, Jr., Charles, Boston, Mass.
Wiley, George L., New York City.
Lemon, C., Wellington, New Zealand.

APPENDIX D.

CONSTITUTION.

ARTICLE I.—NAME.

The name of the Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual, but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, provided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of the Secretary and the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—Vice-President.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—Secretary.

The Secretary shall keep a record of the proceedings of all the meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—Treasurer.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—Executive Committee.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by the provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Secretary and transmit to the Association all applications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting, and the action of this Committee shall not be final, but advisory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—Advisory Committee.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws, as in their opinion will best further the aims and purposes of the Association.

3. The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, affecting telephone interests, and shall report thereon to the Association with such recommendations as it may deem advisable.

4. It may also consider any questions touching the interests of the members of this Association that may be referred to it, and may call for papers or other

documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, so far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committe which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other person, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands, beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. The Association at its annual meetings, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting.

2. Special meetings of the Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the constitution, and shall be payable yearly on or before the first day of October in each year for the year ending August 31st, thereafter.

2. The Association may, by resolution adopted by a majority of all the voters of the Association, make assessments on the members thereof, and such assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

ARTICLE XV.—Expulsion.

Any member may be suspended or expelled for misconduct, or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—Amendments.

1. This Constitution shall go into effect immediately.

2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

3. Notice of such proposed change should be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post-office address of each member.

ARTICLE XVII.—Honorary Membership.

1. Any person nominated by the Executive Committee may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such elections to be by ballot.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

ARTICLE XVIII.—Associate Membership.

1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

2. An Associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments.

APPENDIX E.

BY-LAWS.

ARTICLE I.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—PRESIDENT.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—SECRETARY.

§ 1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

§ 2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the object for which they are called ; and shall keep correctly the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

§ 3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

§ 4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipts and disposals upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

§ 5. Shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business, as have heretofore been furnished by the various committees of this Association.

ARTICLE IV.—TREASURER.

§ 1. The Treasurer shall keep an accurate roll of the members, and shall collect, under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

§ 2. Shall keep regular books of accounts, which shall be opened to inspection by any member of the Executive Committee.

§ 3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

§ 4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—Committees.

§ 1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of the Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said committee, who will, in case it is not deemed expedient to hold a meeting of said committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report with the Secretary.

§ 2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this Committee.

ARTICLE VI.—Membership.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of the Board of its Directors, make application for membership, and shall forward a copy of such proceedings properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition, when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—Non-payment of Dues.

If any member fails to pay the yearly dues or assessments within one month from the first day of October, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that

unless the same are paid within one month thereafter, the default will be reported to the Executive Committee; which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—Amendments.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting, provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—Suspension of Rules.

These rules may be suspended at any meeting of the Association by a majority of all the votes represented at such meeting.

ARTICLE X.—Statistical Committee.

At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be ex-officio chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require.

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TENTH MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

ASSOCIATION,

HELD AT

Hotel Brunswick, New York City,

September 4th and 5th, 1888.

1888.

PRESS OF
BROOKLYN DAILY EAGLE
JOB PRINTING DEP'T,
BROOKLYN, N. Y.

TENTH MEETING

OF THE

National Telephone Exchange Association.

HELD AT THE

HOTEL BRUNSWICK, NEW YORK CITY,

SEPTEMBER 4th and 5th, 1888.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11 A. M., the President, Henry Metzger, of Pittsburgh, in the Chair, and C. H. Barney, of New York, Secretary.

THE PRESIDENT—The first business of the day is the calling of the roll. The Secretary will please call the roll.

THE SECRETARY—As the roll is called I would thank the delegates present, representing the different companies, to hand up their cards to the desk here, so that their names may be accurately inserted in the minutes. Sometimes a name written on the register is not quite so plain as a printed card.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session.

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Edward J. Hall, Jr., Vice-President and General Manager; Angus S. Hibbard, General Superintendent; F. A. Pickernell, Electrician; Ronald Crawford, Francis J. Hovey, Special Agents.

BELL TELEPHONE COMPANY OF BUFFALO, Buffalo, N. Y.—Edward J. Hall, Vice-President and General Manager.

BELL TELEPHONE COMPANY OF MISSOURI, St. Louis, Mo.—George F. Durant, General Manager.

BELL TELEPHONE COMPANY OF PHILADELPHIA, Philadelphia, Penn.—Samuel M. Plush, General Manager.

CENTRAL DISTRICT AND PRINTING TELEGRAPH COMPANY, Pittsburg, Penn.—Henry Metzger, General Manager.

CENTRAL PENNSYLVANIA TELEPHONE AND SUPPLY COMPANY, Williamsport, Penn.—R. M. Bailey, General Manager.

CITY AND SUBURBAN TELEGRAPH ASSOCIATION, Cincinnati, O.—A. D. Bullock, President.

COLORADO TELEPHONE COMPANY, Denver, Col.—E. B. Field, General Manager.

CHESAPEAKE AND POTOMAC TELEPHONE COMPANY, Washington, D. C.—Samuel M. Bryan, President; J. E. Crandall, Electrician; H. W. Upperman, J. E. Smith, Electricians.

CENTRAL NEW YORK TELEPHONE AND TELEGRAPH COMPANY, Utica, N. Y.—H. L. Storke, President; F. G. Wood, Secretary and Treasurer; C. A. Nicholson, General Manager.

DELAWARE AND ATLANTIC TELEPHONE AND TELEGRAPH COMPANY, Philadelphia, Penn.—W. T. Westbrook, Superintendent.

EMPIRE STATE TELEPHONE AND TELEGRAPH COMPANY, Auburn, N. Y.—H. L. Storke, President.

ERIE TELEPHONE AND TELEGRAPH COMPANY, Lowell, Mass.—Charles J. Glidden, Treasurer.

GREAT SOUTHERN TELEPHONE AND TELEGRAPH COMPANY, New Orleans, La.—J. J. Fowler, General Manager.

HUDSON RIVER TELEPHONE COMPANY, New York City.—A. B. Uline, Vice-President; H. L. Storke, Treasurer; William H. Cull, Superintendent.

METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Theodore N. Vail, President; W. H. Eckert, General Manager; W. A. Vail, General Superintendent; A. S. Dodd, Treasurer; J. A. Seeley, Electrician; Leonard F. Beckwith, Chief Engineer.

MISSOURI AND KANSAS TELEPHONE COMPANY, Kansas City. Mo.—Charles W. McDaniel, Superintendent.

MICHIGAN TELEPHONE COMPANY, Detroit, Mich.—F. A. Forbes, General Superintendent; James R. Dee, Division Superintendent.

NEBRASKA TELEPHONE COMPANY, Omaha, Neb.—Flemon Drake, General Manager.

NEW YORK AND NEW JERSEY TELEPHONE COMPANY, Brooklyn, N. Y.—C. F. Cutler, President; W. D. Sargent, General Manager; Joel C. Clark, Treasurer; J. C. Reilly, Superintendent; H. G. McCully, Assistant Superintendent.

NEW YORK AND PENNSYLVANIA TELEPHONE COMPANY, New York City.—W. N. Estabrook, General Manager; Joel C. Clark, Secretary and Treasurer.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, Boston, Mass.—W. J. Denver, General Manager; F. J. Boynton, Secretary and Auditor; Nathan W. Lillie, Purchasing Agent; J. H. Farnham, Electrician.

OHIO VALLEY TELEPHONE COMPANY, Louisville, Ky.—J. B. Speed, President; James Clarke, Vice-President and Treasurer; H. N. Gifford, General Manager.

PENNSYLVANIA TELEPHONE COMPANY, Harrisburgh, Pa.—J. B. Ker, General Manager; W. Bampfield, Division Superintendent.

PROVIDENCE TELEPHONE COMPANY, Providence, R. I.—A. C. White, Superintendent.

SOUTHERN BELL TELEPHONE COMPANY, New York City.—D. I. Carson, General Superintendent; Charles Dutton, Auditor; C. E. McCluer, First District Superintendent; J. D. Easterlin, Second District Superintendent; W. J. Cole, Third District Superintendent.

SOUTHERN MASSACHUSETTS TELEPHONE COMPANY, New Bedford, Mass.—Samuel Ivers, Treasurer.

SOUTHERN NEW ENGLAND TELEPHONE COMPANY, New Haven, Conn.—Morris F. Tyler, President; E. B. Baker, General Superintendent.

ASSOCIATE MEMBERS.

AMERICAN ELECTRICAL WORKS, Providence, R. I.—P. C. Ackerman, Agent.

HOTCHKISS, CLARK B., New York City, by C. E. McClees.

J. A. ROEBLING'S SON'S COMPANY, New York City.—Fred. A. Angell.

NATIONAL CONDUIT MANUFACTURING COMPANY, New York City.—P. J. McQuaide, Secretary; E. S. Perot, General Manager.

STANDARD ELECTRIC COMPANY, Cincinnati, O.—E. V. Cherry, President.

WESTERN ELECTRIC COMPANY, Chicago, Ill.—J. M. Jackson, C. A. Brown, H. B. Thayer, J. J. Carty, Geo. L. Beetle, A. L. Salt, F. W. Harrington, C. E. Scribner.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE COMPANY, Boston, Mass.—C. Jay French, Thomas D. Lockwood, Thomas B. Doolittle, A. O. Morgan, George Albree, David B. Parker, W. A. Hovey, J. M. Brown, Frank B. Knight, H. S. Huidekoper.

BELL TELEPHONE COMPANY, Montreal, Canada.—C. F. Sise, H. S. Thornberry.

BRIDGEPORT BRASS COMPANY, Bridgeport, Conn.—Frederick A. Mason, Henry D. Stanley.

BEETLE, GEORGE L., New York City.

CHILDS, W. A.. New York City.
CHEEVER, CHAS. A., New York City, by Geo. T. Manson and J. A. Wetmore.
DANA, R. K., by T. T. Smith.
VAIL, THEODORE N., New York City.
DAY, A. G., New York City, by C. E. McClees.
LOCKWOOD, THOMAS D., Boston, Mass.
WILEY, GEO. L., New York City.

There were present at the Convention 28 active, 6 associate, and 11 honorary members, represented by 90 delegates.*

THE PRESIDENT—Gentlemen of the Association: I have the honor of introducing to you Mr. Henry C. Davis, President of the Electric Club of New York City, who desires to extend, on behalf of the Electric Club and of the citizens of New York, a cordial welcome to the metropolis of the country. [Applause.]

MR. DAVIS—Mr. President and Gentlemen of the National Telephone Exchange Association: On behalf of the Electric Club of New York I am here to confirm our invitation of a year ago and extend to you a cordial welcome to our Club, and trust that you will enjoy yourselves there to the extent that your predecessors of last week, I believe, have done.

I was asked to be here at eleven o'clock; I came a little

*The following institutions, newspapers and business concerns, not members of the Association, were also in attendance at the meeting:

Baker & Co., Newark, N. J.. by C. O. Baker, Jr.
Board of Electrical Control, New York City, by Schuyler S. Wheeler, Expert Electrician.
C. N. McIntyre & Co., Newark, N. J.
Edison Machine Works, New York City, by J. F. Riley.
Electrical Accumulator Co., New York City, by C. R. Truex.
"Electrical Age," New York City, by J. B. Taltival.
Electric Club, New York City, Henry C. Davis, President.
"Electrical Review," New York City, by Chas. W. Price and C. H. Vanderburgh.
"Electrical World," New York City," by T. C. Martin, C. E. Stump and Jos. Metzler.
"Modern Light and Heat," Boston, Mass., by Ralph W. Pope.
New York Insulated Wire Co., New York City, by J. W. Godfrey.
"Pittsburgh Post," Pittsburgh, Pa., by M. M. Ogden.
The E. S. Greeley Co., New York City, by F. A. McGee.
The H. B. Cox Electric Co., New Haven, Conn., by T. Atwater Barnes and J. E. McConnell.
"Western Electrician," by George H. Guy.
All the New York daily papers were also represented.

late, feeling very much like the man who was going to be hung, and who was perfectly willing to be late, if he could be. I am a better listener than a speaker.

In extending our invitation to you the intention was that you should hold your Convention in our lecture room, but I am happy to congratulate you upon your numbers being too large to be comfortably accommodated in our limited quarters. I also want to congratulate you upon the fact that you have only one parent company to deal with instead of a conglomeration of parent companies, as the National Electric Light Association has, each believing that its own apparatus is the best and the one that you ought to adopt and use. You have to a certain extent a kindred interest with that association, and I trust that your struggle with the underground conduit system will be a success. [Applause.]

THE PRESIDENT—The Chair, on behalf of the Association, returns thanks to President Davis for the kind invitation, and I have no doubt the members will all cordially accept his very kind invitation to the Electric Club and the usual courtesies of the city.

The next business before the Convention is the nomination of new members. Are there any new names to be proposed?

THE SECRETARY—Mr. President, I have the following application for associate membership:

C. H. BARNEY, ESQ., *Secretary:*

Dear sir:—We hereby make application for associate membership in the National Telephone Exchange Association.

Yours truly,

THE NATIONAL CONDUIT MANUFACTURING COMPANY,

J. P. MCQUAIDE,

Secretary.

THE PRESIDENT—The application of the National Conduit Manufacturing Company will be referred, under the rules, to the Executive Committee, for investigation and report.

Are there any other applications?

THE SECRETARY—There are no other applications.

THE PRESIDENT—The next business before the Association is the report of the Secretary.

The Secretary read his report as follows:

SECRETARY'S REPORT.

NEW YORK CITY, September 1, 1888.

To the National Telephone Exchange Association:

GENTLEMEN—I have the honor respectfully to submit my report, as Secretary of this Association, for the year ending August 31, 1888.

The only change in the membership since my last report has been a gain of one active member, the Central Union Telephone Company, having been admitted at the Pittsburgh meeting. The Association, therefore, now numbers 36 active, 5 associate and 29 honorary members. The resignation of the East Tennessee Telephone Company (which has passed into the hands of a new management during the year) has been received, and this, together with those of the Great Southern Telephone and Telegraph Company, of New Orleans, and the Cumberland Telephone and Telegraph Company, of Nashville, is in the hands of the Secretary for the action of this meeting. The latter two were reported one year ago, but no action was taken upon them. These companies are still receiving all the benefits of the Association without paying any dues, and as they are still carried on the rolls of the Association, these dues are accumulating upon the books of the Treasurer. It is, therefore, desirable that some ction in their cases should be taken before we commence another fiscal year.

On the first of May last, the office of the Secretary was removed to the Metropolitan Telephone Company's Building, No. 18 Courtlandt street, Room 512, where it still remains.

The routine business of the office has been much the same as that of the previous year. The publication of the semi-monthly NEWS LETTER has been kept up, and numerous inquiries for information answered from time to time. In addition to the exchanges in this city, and in the adjacent suburban territory of Long Island and New Jersey, the Secretary has visited as many other Telephone offices as circumstances would permit, and during the year just closed, has had the pleasure of looking into those of Boston, Providence, Philadelphia, Pittsburgh, Washington, Chicago, Milwaukee, Detroit, Minneapolis and St. Paul.

As will be shown by the report of the Treasurer, the expenses of the year have slightly exceeded the income; all bills against the Association have been paid to date, and there remains a balance in the hands of the Treasurer of $21.85.

The income of the year was derived from the following sources:

From annual dues	$1,900 00
" initiation fees	10 00
" sales of extra copies of proceedings	27 69
Total	$1,937 69

The distribution of the expenses is as follows:

For salary of Secretary	$1,200 00
" rent of office	120 00
" printing proceedings Pittsburgh meeting	221 25
" other printing, *News-Letter*, circulars and blanks	138 80
" office expenses, stationery, postage, telegrams, express and newspaper subscriptions	152 51
" Stenographer at Pittsburgh meeting	59 25
" other expenses at Pittsburgh meeting	61 36
Total	$1,953 17

Aside from the cash in the hands of the Treasurer, the assets of the Association consist of a small amount of office furniture and stationery, and a number of copies of the printed proceedings of several of the previous meetings, for which there is occasionally a call.

Respectfully submitted,

C. H. BARNEY,
Secretary.

THE PRESIDENT—Gentlemen, you have heard the report of the Secretary. What is your pleasure?

MR. GIFFORD—I move that it be accepted and placed on file.

The motion was carried.

THE PRESIDENT—According to the report of the Secretary it appears that the Cumberland Telephone Company, the Great Southern Telephone Company and the East Tennessee Telephone Company have tendered their resignations, but in the meantime they have fallen behind in the payment of their dues. I think it very proper that some action should be taken by the Association in regard to the further continuance of the membership of these Companies. It is proper, I think, that they should be stricken from the list under whatever conditions the Association may deem necessary to impose—for instance, probably, the payment of dues up to the time that they have offered their resignations. I should be glad to entertain a motion of that kind.

MR. STORKE—Are either of them represented here to-day, Mr. President?

THE SECRETARY—The Great Southern has a representative here.

MR. DURANT—I would move that the three cases men-

tioned be referred to the Executive Committee with power to act.

MR. STORKE—I second the motion.

MR. SARGENT—I notice the Clark Insulated Wire Company on the roll of honorary members. That Company has passed out of existence, and if it is in order, it seems to me, it would be well to include that name also for the consideration of the Executive Committee. I think, perhaps, there are other names on the list of honorary members that other members may know of that ought to be stricken out. The Clark Insulated Wire Company, I know positively, has gone out of existence entirely.

MR. DURANT—I accept the amendment.

THE PRESIDENT - I would suggest that Mr. Durant extend his motion so that any other names on the list of active or honorary or associate members may be investigated by the Executive Committee.

MR. DURANT—I accept that, sir.

The motion was carried.

THE PRESIDENT—The next business before the Association is the report of the Treasurer.

MR. H. L, STORKE (Treasurer)—Mr. President, I have to report that the finances of the National Telephone Exchange Association are in a sound condition. The Association enters upon the next year of its existence with a surplus of $21.85. The surplus of $37.23 of a year ago has been slightly reduced. It would have been impossible, under the circumstances, to reduce it more than slightly. I have here the vouchers for all disbursements. The receipts of the year have been $1,937.69 and the dibursements $1,953.17; that is, during the year the actual expenses have slightly exceeded the revenue. If it is the pleasure of the Convention I move the reference of this report with the vouchers to the Executive Committee, without reading the details.

The motion was seconded.

THE PRESIDENT—It is not necessary to take a vote on that. It will be so ordered.

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

TREASURER'S STATEMENT YEAR ENDING, AUGUST 31, 1888.

RECEIPTS.		DISBURSEMENTS.				
1887.		1887.				
Sept. 1—To balance	$37 33	Sept. 24—By C. H. Barney	Voucher No.	165..	$100 00	
" 24— " C. B. Hotchkiss, Dues for 1888	50 00	Oct. 10— " C. H. Barney	" "	161..	50 11	
" 24— " City and Suburban Telegraph Association, Dues for 1888	50 00	" 10— " R. H. Radford	" "	162..	11 25	
" 24— " Metropolitan Telephone and Telegraph Co., Dues for 1888	50 00	" 10— " C. H. Barney	" "	163..	15 70	
" 24— " Delaware and Atlantic Telephone and Telegraph Co., Dues for 1888	50 00	" 10— " American Press Information Bureau	" "	164..	3 60	
" 24— " American Telephone and Telegraph Co,, Dues for 1888	50 00	" 13— " R. W. Ryan	" "	166..	59 25	
" 24— " Chicago Telephone Co , Dues for 1888	50 00	" 24— " C. H. Barney	" "	167..	100 00	
" 24— " American Electrical Works, Dues for 1888	50 00	Nov. 16— " Brooklyn Daily Eagle	" "	168..	7 50	
" 24— " New England Telephone and Telegraph Co., Dues for 1888	50 00	" 16— " C. H. Barney	" "	169..	12 42	
" 24— " Bell Telephone Co , of Buffalo, Dues for 1888	50 00	" 16— " American Press Information Bureau	" "	170..	3 50	
" 24— " Ohio Valley Telephone Co., Dues for 1888	50 00	" 30— " C. H. Barney	" "	172..	100 00	
" 28— " Chesapeake and Potomac Telephone Co., Dues for 1888	50 00	Dec. 15— " C. H. Barney	" "	174..	11 75	
" 29— " Providence Telephone Co,, Dues for 1888	50 00	" 15— " American Press Information Bureau	" "	171..	5 55	
		" 15— " The Jersey City Printing Co.	" "	173..	37 55	
		" 29— " C. H. Barney	" "	175..	100 00	
Carried forward	$637 33	Carried forward			$617 98	

	Brought forward		$637 33
Sept.	30	To Missouri and Kansas Telephone Co., Dues for 1888	50 00
"	30	" Pennsylvania Telephone Co., Dues for 1888	50 00
Oct.	1	" Standard Electric Works, Dues for 1888	50 00
"	3	" Bell Telephone Co., of Missouri, Dues for 1888	50 00
"	4	" Central District and Printing Co., Dues for 1888	50 00
"	4	" Western Electric Co., Dues for 1888	50 00
"	4	" Michigan Telephone Co., Dues for 1888	50 00
"	5	" J. A. Roebling's Sons Co., Dues for 1888	50 00
"	5	" Pacific Bell Telephone Co., Dues for 1888	50 00
"	6	" Bell Telephone Co., of Philadelphia, Dues for 1888	50 00
"	6	" New York and New Jersey Telephone Co., Dues for 1888	50 00
"	6	" Sunset Telephone and Telegraph Co., Dues for 1888	50 00
"	6	" Hudson River Telephone Co., Dues for 1888	50 00
"	6	" Wisconsin Telephone Co., Dues for 1888	50 00
"	15	" Central Union Telephone Co., Initiation	10 00
"	15	" Central Union Telephone Co., Dues for 1888	50 00
"	15	" Colorado Telephone Co., Dues for 1888	50 00
"	31	" Nebraska Telephone Co., Dues for 1888	50 00
Nov.	29	" Central Pennsylvania Telephone and Supply Co., Dues for 1888	50 00

	Brought forward					$617 98
1888.						
Jan.	12	By American Press Information Bureau	Voucher	No.	176.	10 00
"	12	" C. H. Barney	"	"	177.	15 20
"	12	" The Electrical Review	"	"	178.	3 00
"	12	" The Jersey City Printing Co	"	"	179.	10 00
"	31	" C. H. Barney	"	"	183.	100 00
Feb.	29	" C. H. Barney	"	"	184.	100 00
"	29	" C. H. Barney	"	"	181.	11 20
"	29	" C. H. Barney	"	"	186.	11 50
Mar.	20	" American Press Information Bureau	"	"	185, 182	16 30
April	4	" C. H. Barney	"	"	187.	100 00
"	26	" American Press Information Bureau	"	"	190.	12 90
"	26	" The Jersey City Printing Co	"	"	188.	13 00
May	3	" C. H. Barney	"	"	191.	100 00
"	9	" C. H. Barney	"	"	189.	11 50
"	9	" The Jersey City Printing Co	"	"	192.	13 75
"	9	" C. H. Barney	"	"	193.	11 90
"	9	" American Press Information Bureau	"	"	194.	6 55

Nov. 29—	"	Southern Bell Telephone and Telegraph Co., Dues for 1888					50 00
1888.							
Jan. 27—	"	Erie Telegraph and Telephone Co., Dues for 1888					50 00
" 29—	"	Rocky Mountain Bell Telephone Co., Dues for 1888					50 00
" 29—	"	American Bell Telephone Co., Copies of Meetings					4 16
" 30—	"	Central New York Telephone and Telegraph Co., Dues for 1888					50 00
" 31—	"	New York and Pennsylvania Telephone and Telegraph Co., Dues for 1888					50 00
Mar. 28—	"	Western Electric Co., Copies of Meetings					6 00
April 4—	"	Empire State Telephone and Telegraph Co., Dues for 1888					50 00
" 4—	"	Southern New England Telephone Co., Dues for 1888					50 00
" 4—	"	Southern Massachusetts Telephone Co., Dues for 1888					50 00
Aug. 18—	"	Western Electric Co., Copies of Meetings					2 50
" 31—	"	Bell Telepone Co., of Canada, 6 Copies of Meetings					6 24
" 31—	"	Hadley & Co , 7 Copies of Meetings					7 75
" 31—	"	Spokane Falls Telephone Co., 1 Copy of Meetings					1 04
							$1,975 02
June 21—	"	American Press Information Bureau	"	"	198..		9 25
" 25—	"	C. H. Barney	"	"	195..		100 00
" 25—	"	C. H. Barney	"	"	197..		16 90
" 25—	"	Jersey City Printing Co.	"	"	196..		15 00
July 10—	"	C. H. Barney	"	"	199..		100 00
" 26—	"	C. H Barney	"	"	205..		100 00
Aug. 14—	"	Broun, Greene & Adams	"	"	200..		6 75
" 14—	"	Jersey City Printing Co.	"	"	201..		11 85
" 14—	"	John C. Rankin, Jr.	"	"	202..		6 00
" 14—	"	C. H. Barney	"	"	204..		13 91
" 14—	"	C. H. Barney	"	"	207..		13 06
" 22—	"	C. H. Barney	"	"	208..		100 00
" 22—	"	Jersey City Printing Co.	"	"	206..		22 25
" 29—	"	Brooklyn Daily Eagle	"	"	180..		221 25
" 29—	"	American Press Information Bureau	"	"	203..		7 45
" 29—	"	C. H. Barney	"	"	213..		9 50
" 29—	"	John C. Rankin, Jr.	"	"	212..		95
" 29—	"	American Press Information Bureau	"	"	211..		6 85
" 29—	"	C. H. Barney	"	"	210..		11 82
" 29—	"	Jersey City Printing Co.	"	"	209..		15 40
" 29—	"	Balance					21 85
							$1,975 02

The next business before the Association is the reading of the minutes of the session held by the Executive Committee this morning. They will be read by the Secretary.

The minutes of the meetings of the Executive Committee, held since the last meeting of the Association, were read by the Secretary as follows:

MINUTES OF MEETING OF THE EXECUTIVE COMMITTEE,

HELD SEPTEMBER 27, 1887.

The Committee met at the Monongahela House, Pittsburgh, Pa., at 2 P. M. Present: President Metzger, Messrs. Bailey, Bennett and Bryan.

It was voted to appoint C. H. Barney Secretary of the Association for the ensuing year, at a salary of $1,200 per year.

There being no further business, the meeting adjourned.

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 4, 1888.

The Committee met at the Hotel Brunswick, New York, at 9.30 A. M. Present: President Metzger, Messrs. Bailey and Bryan.

It was voted to recommend the following as the hours of business for the present meeting of the Association, viz.:

On Tuesday, September 4, from 11 A. M. to 1 P. M., and from 2.30 to 5 P. M.

On Wednesday, September 5, from 10 A. M. to 2.30 P. M.

It was voted to recommend to the Association that an Executive Session of the same be held, commencing at 2.30 this P. M.

C. H. BARNEY,
Secretary.

MR. STORKE—I move the adoption of the report of the Executive Committee.

THE PRESIDENT—And that its recommendations be adopted?

MR. STORKE—That is included in my motion.

The motion was carried.

THE SECRETARY—I would state that no amendments to the Constitution and By-Laws have been received for the consideration of this meeting.

THE PRESIDENT—The next business is the election of officers to serve for the ensuing year.

Mr. TYLER—I want to place in nomination a member of the Association for President. Of course I should not venture to nominate for this office one who was not thoroughly well known to us, nor after the experience of the past year and the last meeting of the Association would I place in nomination before you one who had had no experience in the chair; but I think it will meet with the approval of all members of the Association who were at Pittsburgh to have Mr. Henry Metzger nominated to succeed himself as President of the Association. [Applause].

MR. SARGENT (Vice-President)—I second that motion. I also move that the Secretary be instructed to cast the ballot of the Association for Mr. Metzger as his own successor. To save the President from any embarrassment I will put that motion myself. It is moved and seconded that Mr. Henry Metzger be unamiously elected as his own successor for the incoming year. All in favor will say aye.

The motion was carried.

MR. METZGER—Gentlemen of the Association, I can only thank you for this evidence of renewed confidence on your part in re-electing me to the office of President. It is usual on occasions of this kind for a retiring President—and in this case the same person is also to be President of the Association for the ensuing year—to offer a few brief remarks upon matters germane to the purpose for which we have assembled. According to the Constitution, the object of the Association is to collect, preserve and protect the various matters of importance to telephone interests, and how well this Association has succeeded in executing this trust can be answered by referring to the telephone statistics of the day. Every city, town and village in your country, from the Atlantic to the Pacific, from the borders of Canada to the Gulf of Mexico, gives visible evidence of the work you have performed in developing the telephone business. But I do not intend to take you back and recall the history of the past. It is sufficient for me to ask you to go to that period of time, one year ago, when we were assembled in the city of Pittsburgh. It was a time pregnant with uncertainties and doubts as to

what the status of the telephone companies would be for the coming, that is to say, what is now the past year, and probably for all time. It is true that every Circuit Court of the United States, wherever the American Bell Telephone Company has brought suit, had granted preliminary and final injunctions against infringers whether defended by Government aid or by private wealth and influence. Yet there still remained a doubt as to what the final outcome would be. The glorious uncertainties of the law were too well known to all of us, and although our faith in the righteousness of our cause was firmly grounded, yet some unexpected resistance might develop that would weaken our faith in the wisdom, justice and honesty of men. After a long, bitter and expensive struggle the day of judgment came. It was delivered by that honest and eminent jurist, Morrison R. Waite, the late Chief Justice of the Supreme Court, whose memory, I think, the telephonic fraternity should revere, and over whose grave we can all shed the tear of regret at his untimely death. But before yielding up his life he placed the seal of judicial authority upon the scroll of fame that bore the name of Alexander Graham Bell as the inventor of the speaking telephone. [Applause]. And in this connection I cannot forbear saying to the Association that we are much indebted to those two eminent attorneys, J. J. Storrow and E. N. Dickerson, for their masterly knowledge of the science of telephony and their keen analysis of the evidence as produced in the various causes which they argued.

Since that time we have had a period of repose; a feeling of security has pervaded the minds of our stockholders in regard to the safety and permanency of their investments. In many cases the directors of companies have entered into a more liberal policy, one more in accord with the necessity and requirements of the business. In some cases, notably in New York, Chicago, Baltimore and Pittsburgh, new buildings have been erected suitable for carrying on the business in which we are engaged. In some other cases underground systems have been laid, either new plants or extensions of existing ones. Multiple switch-boards have taken the place

of old and worn out systems—systems that were a constant source of discomfort to subscribers and telephone managers. In some other cases larger poles have been erected, copper wire has largely taken the place of iron and steel, and good insulation the place of poor, or perhaps none at all. But, while much has been done, much more remains to be done in the next three or four years if the members of this Association desire to retain control of the business which they have created and developed. In the sphere in which we move and perform our work we may be kings, but there is a greater circle beyond that in which a constant power is being exerted that will in a very short and limited time compel you—compel us all, to give the best of service and at the cheapest cost, so cheap, in fact, that your competitor of the future may well hesitate at the threshold before entering the field with hopes of a successful venture. But the day of the inevitable conflict is bound to come, and it is your bounden duty to your stockholders, and in justice to yourselves, to prepare for that day. The maxims, "In time of peace prepare for war," and "Make hay while the sun shines," are worthy of your serious consideration. It will not do for you to fold your hands and rest content with the fruits of the legal victories of the American Bell Telephone. The competitor of the future will be no less relentless than the infringer of the past, watching every movement that you make, noting every step of progress; he is but waiting for the day and the opportunity either to divide the business with you or perhaps to absorb it entirely.

I now, gentlemen, desire to return again my thanks to the Association for your very kind treatment of the Chairman, in fact from the very time I first entered your midst at Niagara Falls to the present moment. (Applause.)

The next business before the Association is the election of Vice-President; are there any nominations?

MR. STORKE—I would move, Mr. President, the nomination of Mr. W. D. Sargent for Vice-President.

The nomination was seconded.

MR. EASTABROOK—I ask unanimous consent that the

Secretary be allowed to cast one ballot for the name of W. D. Sargent for Vice-President.

THE PRESIDENT—If there is no objection it will be so ordered.

The Secretary cast the ballot of the Association for W. D. Sargent for Vice-President of the Association, to serve for the ensuing year.

THE PRESIDENT—The next business in order is the election of the Treasurer. Are there any nominations?

MR. DURANT—Mr. President, I nominate Mr. Storke, and I move that the nominations be closed and that the Secretary be authorized to cast the ballot of the Association for Mr. Storke.

THE PRESIDENT—It is moved that our present worthy and efficient Treasurer be renominated for the office of Treasurer, and that the Secretary be instructed to cast the vote of the Association.

The Secretary having cast the vote, Mr. Storke will consider himself re-elected.

The next business is the election of a member of the Advisory Committee in place of Morris F. Tyler, of New Haven, Conn., whose term has expired. Are there any nominations?

MR. JOEL C. CLARK—I move you that Mr. Tyler be his own successor.

The motion was seconded and carried.

THE PRESIDENT—The next business is the nomination and election of four members of the Executive Committee, the President being an *ex-officio* member of the same. The present members are R. M. Bailey, of Williamsport, Pa.; George N. Stone, of Cincinnati, Ohio; J. W. Bennett, of Lowell, Mass; and Samuel M. Bryan, of Washington, D. C.

MR SARGENT—I nominate Mr. Edward J. Hall, Jr., of New York.

THE SECRETARY—Mr. Hall is at present a member of the Advisory Committee. I suppose he might resign from that Committee and be elected on the Executive Committee, however.

A MEMBER—I nominate Mr. Samuel M. Bryan.

THE PRESIDENT—The Chair takes the liberty of nominating R. M. Bailey, of Williamsport, Pa., who is now a member of the Executive Committee.

MR. GLIDDEN—I nominate W. J. Denver, of Boston.

MR. DURANT—I nominate D. I. Carson, of New York.

MR. BULLOCK—I nominate George N. Stone.

THE PRESIDENT—In reference to the nomination of Mr. Carson, I understand he has gone into another business. I may be wrongly informed, however.

MR. DURANT—He is here. He is still on the old ground, I think.

THE PRESIDENT—The nominations are Samuel M. Bryan, of Washington, D. C.; R. M. Bailey, of Williamsport, Pa.; W. J. Denver, of Boston; D. I. Carson, of New York, and George N. Stone, of Cincinnati, Ohio.

MR. CARSON—It occurs to me that it would be proper to follow the example set in the beginning of the meeting and re-elect the entire membership of the Executive Committee, and I nominate Mr. Bennett, and would like to withdraw my name in his favor.

THE PRESIDENT—It is the opinion of the Chair that it is not advisable to re-elect the entire old Board. There are matters of importance that will probably come before the Executive Committee, and that will require action by them, and a full attendance is desirable. Neither Mr. Bennett nor Mr. Stone is present, and it would be much better for the interests of the Association, if persons who are present and who can take part in the active proceedings should be selected.

THE SECRETARY—I would say, Mr. President, that Mr. Glidden has stated to me that as Mr. Bennett is no longer an officer of the Erie Company, it would be the wish of that Company that some other member of the Association should be put in his place; that is, that some other Company of the active membership should be represented on the Executive Committee, and as Mr. Glidden has nominated Mr. Denver,

I presume he wishes his name to take the place of Mr. Bennett's.

MR. EASTABROOK—I move that the Convention proceed to ballot for one member of the Executive Committee; the Secretary to call the roll of members, each member to answer as his name is called, giving his choice. I forget the name of that ballot—the Secretary calling the roll and each member giving his vote.

THE SECRETARY—*Viva voce?*

THE PRESIDENT—My impression is that the Constitution provides for an election by ballot.

MR. EASTABROOK—Is not that a ballot?

THE PRESIDENT—A *viva voce* vote is not by ballot. The Secretary will pass cards around among members of the Association and they can designate on them the members for whom they wish to vote.

MR. DURANT—The intention being to vote for four?

THE PRESIDENT—For four.

MR. DURANT—Do I understand the nominations are still open?

THE PRESIDENT—No, sir; the nominations are closed. However, if it is the wish of the Convention that the nominations shall be reopened, I see no objection to it.

MR. DURANT—Then, sir, I nominate Mr. Thomas D. Lockwood.

THE PRESIDENT—Are there any other nominations?

Mr. SARGENT—I nominate C. F. Cutler of the New York & New Jersey Telephone Company.

THE PRESIDENT—I would suggest to the Association that they write four names on one ticket.

MR. DURANT—Mr. President, Mr. Lockwood, as an honorary member, is eligible, is he not?

THE PRESIDENT—I think the Constitution and By-Laws are silent on that point. The presumption is that Mr. Lockwood is eligible.

If the Association is ready we will proceed to ballot for members of the Executive Committee. Only active mem-

bers are entitled to cast a vote and each Company is entitled to one membership, and as the roll is called the members will please step forward and deposit their ballots. The Secretary will call the roll.

The Secretary called the roll and the voting was proceeded with.

THE PRESIDENT—I appoint as tellers to count these ballots, Mr. Ivers and Mr. Bullock.

The tellers counted the ballots and Mr. Ivers reported the result as follows:

Bryan, eighteen; Stone, seventeen; Denver, fifteen; Cutler, twelve; Bailey, ten; Lockwood, five; Durant, five; Carson, four; Eckert, one; Sargent, one.

THE PRESIDENT—The Chair announces the election of Mr. Samuel M. Bryan,of Washington; Mr. W. J. Denver, of Boston; Mr. George N. Stone, of Cincinnati, Ohio, and Mr. C. F. Cutler, of New York City.

Is there any other business before the Convention before we proceed to the reading of the paper that was to be read this morning on the subject of "Telephone Batteries?"

MR. E. J. HALL, JR.—On behalf of the American Telephone and Telegraph Company, I would like to invite the members of the Association to take a drive to-morrow afternoon through Central and Riverside Parks. Cards of invitation will be issued.

MR. ECKERT—The Metropolitan Telephone and Telegraph Company desires to extend an invitation for an excursion on the North River on Thursday, leaving at half past ten, and going probably as far as West Point, having dinner about six o'clock. Cards of invitation will be sent to all of the members, and I should like to have a response from those who will attend.

MR. THAYER—On behalf of the Western Electric Company, I extend an invitation to the members to take lunch to-morrow afternoon, at Mount St. Vincent, in Central Park, after the drive. Cards of invitation will be sent.

MR. STORKE—I move that all the invitations be accepted with thanks.

MR. DURANT – I move to include in the resolution the invitation from the Electric Club.

THE PRESIDENT—We include the Electric Club in the motion.

The motion was carried.

THE SECRETARY--In order that the gentlemen who have extended these invitations may be facilitated in addressing the individual cards of invitation, and in order that nobody may get left, it is desirable that all those representing the membership of the Association should register their names at the Secretary's office. It will facilitate matters very much.

Referring to the dinner to which Mr. Thayer has invited you, I would say that a photographer was here this morning, who expressed a desire to photograph the members of the Convention in a body, between the termination of the drive which Mr. Hall has tendered, and the dinner which Mr. Thayer has offered, and at some place in front of the Mount St. Vincent Hotel.

MR. STORKE—That is before the dinner, Mr. Secretary? [Laughter.]

THE SECRETARY—Before the dinner. I would also say that I have cards here for all members of the Convention—cards of the Electric Club. Any one who has not yet received one, and who is not a member of the Club, can get a card by applying at the Secretary's office, Parlor L, or at my desk here during the Convention.

THE PRESIDENT—The next matter of business before the Association is the reading of a paper by Mr. F. A. Pickernell, of the American Telephone and Telegraph Company, upon "Telephone Batteries."

NOTES ON TELEPHONE BATTERIES,

BY F. A. PICKERNELL.

I shall not attempt in these notes to recommend or describe any particular battery, but shall content myself with pointing out defects existing in the batteries now commonly used for transmitters, and emphasizing the importance of certain features, which all telephone batteries ought to possess.

The selection of batteries for transmitters has always been a matter of considerable importance, although not always recognized as such. When the bat-

tery transmitter was first introduced, nearly all telephone wires ran on overhead structures, no cables being used. The retardation in these circuits was consequently slight, and it was during this period of the business that the large margin in transmission was observed, it having been found possible to talk with the same ease over circuits 50 miles long as it had previously been over circuits a mile long. This led naturally to poor construction, lines being built with small gauge iron and steel wire, and in many cases without insulators. Such construction cut down this margin of transmission to such an extent that it was found impossible to talk over such lines in bad weather, unless the transmitter and battery were in the very best condition.

Better construction followed, and with better construction the battery problem was of less importance. More recently, however, the extensive introduction of cables has again cut down the *margin* of transmission. This of course renders it necessary to keep the transmitter and its battery in better condition. As the cable system of any telephone exchange increases, in a like ratio will the importance of battery problem increase. It was only last week that a gentleman was telling me of his experience in confirmation of this. His company had a cable 2½ miles long, which not only had a high electro-static capacity, but also a high resistance. This cable was used mainly for trunk wires. It was noticed that many subscribers, who had no difficulty in talking with parties in their own exchange, had considerable difficulty in talking with parties in the other exchanges connected through this cable. Upon inspection it was found that invariably a poor battery was found at the subscribers' instrument. This cable made a very good battery inspector, and one, I may say, that did not ruin the transmitter in inspecting.

The battery most commonly used for transmitters is of the Leclanche form. The little attention required by a battery of this class, its freedom from violent acids, the ease with which it is set up, its small consumption of zinc, there being no consumption when the battery is on open circuit, all unite in making it the leading form of telephone battery. However, it polarizes raipidly, and has a high and constantly increasing internal resistance when worked over a low resistance circuit, as it invariably is when used for transmitters. The importance of low battery resistance is shown clearly by the following considerations:

The efficiency of any transmitter, other things being equal, is proportional to the variation in current strength produced in its primary circuit. The greater the variation in current strength, the greater being the efficiency. The variation in current strength being proportional to the variation in resistance, it follows *that* the efficiency of any transmitter is proportional to the variation of resistance produced in its primary circuit. The following table calculated for a Blake transmitter shows how important is the part, battery resistance plays in modifying this variation in resistance, in other words, in modifying the efficiency of the Blake transmitter.

This table assumes the variations in a Blake transmitter to be from 5 to 15 ohms, these figures being the result of many measurements.

Table for Blake transmitter. Resistance of primary circuit of induction coil .5 ohms.

Battery Resistance.	Minimum Resistance.	Maximum Resistance.	Ratio of Min. to Max.	Percentage decrease of ratio from that of Battery of o Resistance.
.0	5.50	15.50	1:2.82	....
.33	5.83	15.83	1:2.72	3.5
.67	6.17	16.17	1:2.62	7.1
1.00	6.50	16.50	1:2.54	9.9
1.33	6.83	16.83	1:2.46	12 8
1.67	7.17	17.17	1:2.39	15.2
2.00	7.50	17.50	1:2.33	17.4

Two ohms is not an uncommonly high resistance for Leclanche batteries, and from the table we see that the variations from its minimum resistance to the maximum resistance of the primary circuit of a Blake transmitter decreases from a ratio of 1:2.72 in the case of a battery of 33 ohms internal resistance to a ratio of 1:2.33, in the case of a battery of 2 ohms resistance, a decrease of 14 per cent.

With L D transmitters the battery resistance is an even more importent factor, as will be seen by the following table. This calculation for long distance transmitter assumes variation in resistance to be from 4 ohms to 20 ohms, resistance of primary of induction coil .45 ohms. Three cells of Leclanche batteries are generally used with this transmitter.

Battery Resistance.	Minimum Resistance.	Maximum Resistance.	Ratio of Min. to Max.	Percentage decrease of ratio from that of battery of o Resistance.
.0	4.45	20.45	1:4.60	....
.33	5.45	21.45	1:3.94	14.
.67	6.45	22.45	1:3.48	24.
1.00	7.45	23 45	1:3.15	32.
1.33	8.45	24.45	1:2.89	37.
1.67	9.45	25.45	1:2.69	42.
2.00	10.45	26.45	1:2.53	45.

From this table we find that the variation is decreased from 1:3.94 when batteries having internal resistance of .33 ohms are used to a ratio of 1:2.53 when batteries of 2 ohms internal resistance are used.

These tables likewise show why it is that even a slightly defective joint in the primary circuit prevents the action of the transmitter.

Polarization is a defect of even more importance than internal resistance. It is not uncommon for a Leclanche battery to decrease 30 per cent. in E. M. F. after 10 minutes use. This of course decreases the average current in the primary circuit of the transmitter in a like ratio.

Having noticed now the importance of low and constant internal resistance and constant E. M. F., I will next call attention to some of the causes which operate to render telephone batteries not only poor to start with, but unreliable in service. Lack of porosity in the porous cups is frequently the cause of high battery resistance.

Commonly porous cups are found which contain peroxide of manganese dust. This dust should never be admitted, as it invariably increases internal resistance. The peroxide should be in particles about the size of small peas. Binding posts are frequently found which do not make good connections with the electrodes. The binding post on the carbon plate is often found after a few months use to be almost entirely insulated from the plate. This is caused by the salts creeping up through the carbon and corroding the metal binding post. The upper portion of the carbon is supposed to be entirely impregnated with paraffine to prevent this crawling, but very often the carbon is not *soaked* long enough to become thoroughly saturated. Care must be taken not to use an excess of sal-ammoniac in setting the battery up, for otherwise crystals will form on the zinc, increasing very much the internal resistance. If the sal-ammoniac becomes impoverished a complicated chloride of zinc will deposit in the same manner.

A poor quality of the peroxide of manganese is frequently found in porous cups. When such is used polarization takes place very quickly.

Gravity batteries and bichromate of potash batteries have been used to a considerable extent, especially for L. D. transmitters.

These batteries require more attention than the Leclanche battery, and are not so reliable.

The battery which in its electrical properties approaches more nearly the ideal battery, is the storage battery. This combines constant E. M. F., with very low internal resistance. Two cells of storage battery on L. D. transmitter give the very best transmission.

This form of battery cannot, of course, be generally used on subscribers' instruments.

Many modifications of the Leclanche battery have recently been introuduced, some having remarkably low resistance, but they all polarize more quickly than is desirable. I think that if we have not already a modified Leclanche battery that combines low resistance with constant E. M. F., that we will soon have one, and this will be beyond question the telephone battery of the future. I see no reason why a battery of this kind could not be made, having an internal resistance of considerably less than .5 ohms, and a constant E. M. F. of 1.48 volts. This battery could be put up in a package with nothing but the terminals projecting, and these I may say should be provided with the best possible forms of binding posts. By using nothing but the best material and properly designing the electrodes, polarization could, to a very great extent, be prevented, and by properly proportioning the components, exhaustion would take place in all the parts at about the same time. Such a battery would give, when set up, the very best possible results and would require no inspection. When the battery became exhausted no unsatisfactory doctoring would be done by the inspector, he would simply replace a battery by a new one. Until some such battery is generally introduced we may expect about the same percentage of battery troubles as we now are having.

MR. GIFFORD—I have not the pleasure of knowing the gentleman who just read that paper, but I understand he is

comparatively a young man with us. I want to say that while we have discussed conductivity, resistance, insulation, and all those topics until they have got to be chestnuts almost, this is really the first exhaustive and specific paper on the subject of batteries that we have ever heard, I think. It is a very valuable paper and I move that we return the thanks of the Association to the reader of the paper.

MR. BULLOCK—I propose, in connection with that vote of thanks, that the paper be made a part of the minutes, and published.

MR. GIFFORD—I intended to include that.

The motion was carried.

MR. BAILEY—I would like to ask Mr. Pickernell what form of storage batteries he referred to in his paper.

MR. PICKERNELL—The batteries I referred to were the old form of Brush, the first form that came out. I should say that the size was five by eight by twelve—something like that. The two cells of storage battery had two plates each, and the resistance was very low indeed. I did not use the batteries after the electromotive force had commenced to drop out appreciably.

MR. BAILEY—Are they made up of two plates each, one positive and one negative?

MR. PICKERNELL—Yes, sir.

MR. BAILEY—Seven by twelve inches?

MR. PICKERNELL—Yes, sir; something like that. I could not get at the dimensions of the plates exactly. The experiments were made about two years ago.

MR. GIFFORD—There is one other question I would like to ask. I noticed Mr. Pickernell in his paper mentioned the fact that he usually used three Leclanche cells with the long distance transmitter. I wish to say that we have several of these transmitters in use. I started out, rather on my own hook, to see how many cells were wanted. I commenced with one, two and three, and I carried it up to four, and on the line on which we have them in use I found that four cells gave the best result. But I assume that I have a good deal to learn on that subject, and I would like to hear

from some of the members in the Eastern States as to what they usually use, and what number they find produces the best result, and what battery will go farthest. While I do not wish to have the Association espouse the interest of any particular battery I would like to know what battery has been found to be the best for long distance transmitters. That is a practical question that we can discuss here without reflecting upon any particular battery, I think. As a matter of fact we want to get at the very best battery—what has been found to be the best.

MR. SEELEY—I would like to state to members of the Convention that the Metropolitan Company of New York are putting in a storage battery for their transmitters, especially for the exchange work. We are about to use a cell we call "Type D," giving seven amperes of current, internal resistance about 5-1000 of an ohm, two volts E. M. F. Those batteries are about seven inches high by twelve inches square.

MR. LOCKWOOD—Mr. Chairman, I need scarcely say that I, for one, was much pleased with Mr. Pickernell's paper. I am glad to see that the younger men among us take sufficient interest in our work to take the time and pains to write papers for this Association; and I am also glad to see that a spirit of discussion is abroad, because I think we learn just as much from the discussion and from the individual experience of the members as we do from the papers themselves, and sometimes the information we gain from the experience which is given is more valuable, in a practical way, than that contained in the paper itself, whose real value must, of course, always be that of the discussion which it elicits. I trust that the discussion of the papers which are read at this meeting of the Association will be more prevalent and universal than it has been.

I notice, however, one point in Mr. Pickernell's paper which, since it differs from my own experience, I think it proper to refer to especially. It may be that my experience has been a misleading one, and that I am wrong on this point. If I recollect rightly he stated that we are to be

careful in the use of Leclanche batteries, not to use too much sal-ammoniac. If by using too much he means that we are not to fill the jars full and then try to moisten it, I agree with him. If, on the other hand, he means that we must be very chary about putting sal-ammoniac in, I cannot agree with him. As a matter of fact I have found, in the course of some thirteen or fourteen years' experience in telephony and otherwise, that the amount which the dealers, especially the Leclanche Battery Company (who are very careful to send out nothing but good material)—that the amount which they send out of sal-ammoniac is exactly the amount which it is proper to use. In my experience I have found that the amount they put up in their paper packages is just about the correct amount, and that we can neither diminish that nor increase it with advantage. It is true that crystals will form upon the zincs and upon the lower part of the zincs, but as long as crystals of sal-ammoniac only, form on the zinc no great harm will ensue. It is also a fact that when there is too little sal-ammoniac in this solution, oxychlorides of zinc and ammonium at once form on the zinc, and these salts being insoluble, take away so much of the conducting surface of the zinc and thus increase the resistance of the battery, besides preventing the necessary consumption of the zinc, which is absolutely essential to the proper working of a battery.

I did not notice any other point in the paper that I should care to criticise at all, and it may be that this is simply a difference in definition. I dare say when Mr. Pickernell comes to restate his views they will be found to be not far from those which I have enunciated.

I am also very glad to note from what Mr. Seeley says that the Metropolitan Company is making an experiment in the way of using secondary cells. I should like, if I may be allowed, to so far place myself in front of the Association for the moment, as to request Mr. Seeley to do, what I have no doubt he *will* do, to make a careful observation of the result of such batteries, so that at our next meeting we may be enabled to know something about it. Of course if we

had a storage cell,—if we had a secondary battery with just sufficient voltage and furnishing just sufficient current for our needs, no doubt that would be the ideal cell. If we should use such a cell, of course we should be subject to the necessity of recharging, but the Leclanche cell is not wholly free from such disadvantages. The best batteries we have in our telephone work have to be looked after. In 1882, when I was in Cincinnati on a short visit, I found that the Cincinnati service was far ahead of anything that I had ever seen in any exchange before, and when I came to look into the matter I ascribed it more particularly to the constant inspection and the great care exercised by the City and Suburban Telegraph Association of Cincinnati, in looking after their batteries.

MR. PICKERNELL—I would state that I quite agree with Mr Lockwood in respect to his statement about the use of sal-ammoniac. I mentioned that fact, because I found that it was not infrequent for telephone inspectors to put in two of those packages of sal-ammoniac instead of one, thinking that by so doing they might possibly save another inspection in a short time. It is only about two weeks ago that I found three cells of battery which we were using on a long distance transmitter in which the zincs were entirely covered with crystals of sal-ammoniac. The reason my attention was called to the fact was that the transmitter would not work at all; still there was a circuit; you could get the click all right when you moved the telephone hook.

THE PRESIDENT—How many ounces of sal-ammoniac does the Leclanche Company furnish?

MR. PICKERNELL—I think it is four ounces.

MR. GIFFORD—It used to be six, I believe?

MR. PICKERNELL—In reply to the gentleman's question about the number of cells to be used with long distance transmitters, we find, if we use low resistance batteries, that three cells are as good as four, there being practically no difference. But if you have batteries in which the resistance is increased from any cause whatever, you will find that four cells are better than three. In other words, if you should

try to make the experiment by first putting on one cell and talking, and then two and three and four; if you start with a battery having high internal resistance, you will find four will be better. On the other hand, if you use batteries with low internal resistance, you will find three quite as good as four. Of course with three, the chances of trouble are less than with four.

MR. GIFFORD—In selecting batteries for our long distance work we are very careful to see that our batteries are as nearly perfect as possible. When the millenium comes, I suppose we shall have perfect batteries; not before. I am always very careful to select good batteries, and I have found that in some instances four cells give better results than three, although three have worked very well.

One word in regard to sal-ammoniac. That is one of the questions that varies somewhat in different localities. A short, practical rule that I have adopted is to allow an inspector to put in no more sal-ammoniac than you can dissolve in water. I do not leave any at the bottom of the cell at all. I found, as Mr. Pickernell says he found, that inspectors will load up a cell with two or three charges, so that they will not have to go back. I only allow them now to put in as much as you can dissolve. That varies according to the kind of water in different towns. In a town where you use limewater it will not hold so much sal-ammoniac in solution as pure river or rain water will, and in some places where you happen to have water strongly charged with some mineral, it will not dissolve very much. That varies a little. I mention that more as theory than practice. Of course I do not suppose it will make a variation of half an ounce in practice.

MR. THORNBERRY—I would like to ask the gentleman if he finds any deposit on the zinc, in the treatment of the battery which he carries out?

MR. GIFFORD—Sometimes I do. When I am careful not to overcharge the battery, I do not find nearly as much. I presume there is hardly any battery, but what, if you use it long enough, there will be more or less deposit on the zinc. Where you do not overcharge it, it does not deposit nearly as much.

MR THORNBERRY—I was going to say that from my experience I rather favor the disposition of the batteries described by the gentleman who last spoke, in placing just enough sal-ammoniac in the battery to keep it doing its work. I find that the battery, if it is put to hard work, even though it has just sufficient to do the work without more, will deposit these crystals on the zinc. They are indissoluble, and therefore the battery has no zinc in contact with the solution. For that reason we get no current. The value of any battery is proportionate to the current it will give us. That is determined by the internal resistance.

I want to say, in reference to the long distance telephone that where hard work is being done the Leclanche battery will hardly answer the purpose, if it is in an exchange where it is used frequently; but a four or six-cell gravity battery will serve the purpose just as well. That is to be determined by the length of the line on which you wish to work it, or the condition of the battery itself. The sulphate of copper battery, or gravity battery, as we call it, has to be constantly at work or it will polarize itself. If it is constantly at work and cleaned once a week, the gravity battery will give splendid results and give you splendid transmission for your long distance telephone; but we determined some time ago when this telephone first came out that four cells of the Leclanche battery were the best. The first experiments we made were with the Fuller battery. We used three of those, and that gave us six volts, and the internal resistance was about the same as the Leclanche; and then we used the four Leclanche cells, which gave us in the neighborhood of six volts.

MR. BAILEY—The point aimed at seems to be to get an effective working battery of low internal resistance. The gentleman was speaking of the use of a storage battery, Why isn't that of some value? Has any one experimented with the Leclanche batteries on any kind of telephone, in multiple? In using them in multiple you would get much lower internal resistance, I should say, and of course a greater quantity of current.

MR. LOCKWOOD—I did not intend to say anything more on this head, having said my little say, but since the gentleman from Pennsylvania inquires, I might add that some two or three years ago the chief clerk of our Company, Mr. R. W. Devonshire, sent me two or three transmitters with the instruction—I don't know whether it was directed to me specially, or whether it was in the nature of a circular—which gave me the exact information how much battery I ought to use for the long distance transmitter. I did not follow the instructions with great care, and I tried them with a number of cells of different kinds. I tried them successively with one, two, three and four cells of Fuller and different bichromate combinations. I tried them with one, two, three, four, five, six cells of Leclanche and other similar batteries, and I tried them, as Mr. Bailey has spoken of, three in tandem and two abreast—three in series and two in multiple arc, and I found that while that arrangement was new it worked beautifully. It furnished the proper amount of current, or at least it furnished a very good amount of current, and it worked very nicely; but when that battery grew a little older I found that it did not work as well, because it was impossible to make the two sides work alike – one side got a little stronger, and kept getting a little stronger than the other. Consequently instead of both points of the current going *this* way the stronger battery took a notion to polarize, or go against the current of the other side. While it was new it worked very nicely, but after two or three weeks it did not work so well. A better way would be to do, what I am surprised battery manufacturing companies have not done before, to make a larger Leclanche cell. Possibly they may have made them, but they have not got into the market. A demand has arisen, however, for a Leclanche cell about twice the size of the present cell. I have a Fuller battery under my desk and it has worked unchanged for eight months. It works pretty well and you could not tell from the operation that it was an old battery, or that it had not been cleaned for eight or nine months. As there are only two cells, it does not make

much gas and does not annoy me at all. But while acid is good in an office like mine, or in the head-quarters of a telephone company, it is not good for subscribers' stations. So I think that we shall have to put our trust still in the peroxide of manganese battery until we can find that peroxide of lead is as constant as peroxide of manganese, and it is a proper thing, I think, for manufacturers to consider whether they had not better increase the size of them.

The point mentioned by Mr. Gifford that in the batteries for which the Leclanche Battery Company once provided six ounces, they now only provide four, can be accounted for by the fact that there are several sizes of Leclanche batteries, and they have provided six for the larger size and four for the smaller size, and it is always economy where we are buying for telephone transmitters to buy the larger size.

MR. SEELEY—The present plan of the Metropolitan Company is to make an inspection once every month. The solution is thrown out and a new solution made up. Each inspector is provided with a measure, holding four ounces of sal-ammoniac. We guard against overcharging the battteries in that manner. We find that the Gonda porous cup is about as good as the Leclanche battery. Taking the current at the electrodes of the battery we find that we get one and seventh-tenths volts with an internal resistance of one and seventh-tenths ohms. After using that battery through a resistance of 8 ohms for five minutes, we find that the voltage falls to one and three-tenths, with a current of five-tenths of an ampere, and the internal resistance has increased to two and six-tenths volts. By short circuiting the battery for an hour and five minutes we get three-tenths of a volt, three-tenths of an ampere, and one ohm internal resistance. That battery was far ahead of any we experimented with.

THE PRESIDENT—The hour for lunch has arrived, and the Association will now take a recess to meet again at half-past two o'clock, in executive session.

AFTERNOON SESSION.

At 2.30 P. M. the Association reconvened, and immediately went into executive session, all except active members being asked to retire.

No business was transacted, but several matters of interest as bearing on the future of the Association, and of its members were discussed with freedom, fervency and zeal, until 5 P. M., when the meeting adjourned until Wednesday morning, at 10 o'clock.

SECOND DAY'S PROCEEDINGS.

TUESDAY, September 5, 1888.

The meeting was called to order by President Metzger at 10 A. M.

THE PRESIDENT—The first business before the Association this morniug is the reading of the paper by Mr. C. L. McCluer, of Richmond, Va.

MR. MCCLUER—Mr. President and Gentlemen of the Telephone Association: In consequence, I presume, of the fact that I have had unusual facilities for observing the action of dynamo currents upon telephone exchange systems, I have been invited to prepare and read before you this morning a paper upon dynamo currents and their influence upon the telephone exchange systems, and means of prevention. I have endeavored, of course, in the preparation of this paper to make it popular, as far as I could, in character, leaving to our friend Mr. Lockwood the discussion of the subject from a scientific point of view. Perhaps, in justice to myself, I should say that I am at the present moment suffering from my usual attack of hay fever, and under such circumstances it is, sometimes, very difficult for me to articulate with any degree of distinctness. If anything of that kind should occur, I crave your indulgence.

Mr. McCluer then read the following paper:

DYNAMO CURRENT INTERFERENCES WITH TELEPHONE SYSTEMS AND MEANS OF RELIEF.

During my earlier telegraphic experience I became imbued with the universally accepted belief in the theory that the earth was an immense reservoir of electricity, and that on that account, and because of its immense mass. it offered no appreciable resistance to the transmission of electrical force. Hence the universal use of the earth as a return conductor for telegraph and other electrical circuits, which were in consequence called "mixed circuits" in contra-distinction to circuits composed wholly of metallic conductors. But my attention being called to the behavior of our telegraph apparatus under the influence of extraneous currents, I was finally led to question the correctness of the theory of the "infinite conductivity" of the earth.

Like nearly all the early workers in the new field opened up by Prof. A. Graham Bell's invention, I was also led into the error of attributing to "induction" nearly all the ills to which the telephone was heir.

Experience and observation, however, soon convinced me that nearly all the telephone troubles popularly supposed to arise from "induction" were the result of "leakage" only. "Induction" operating only at minute distances, while leakage would occur across wide intervals. Hence I was to some extent prepared for my subsequent experiences with the effects of electric light and electric power circuits upon telephone systems; experiences which, as I will now proceed to explain, confirmed me in my disbelief in the theory of "infinite conductivity" and the effects of "dynamic induction."

Some three or four years ago Richmond was captured by the advance guard of the Army of Knights of the Dynamo, to which she is now so largely tributary, and the Schuyler Electric Light Company soon had the city ablaze with arc lights. At first we experienced little or no trouble, but after a time strange noises were heard in our exchange telephones, and as the electric light construction was extended and circuits and arc lights were multiplied, the noises increased until they finally became a din, over which it was almost impossible to project the voice. After careful consideration I suggested several reversals of dynamo currents and a re-arrangement of the electric light metallic circuits, which were adopted by our electric light friends, greatly to our relief. But on some of our exchange wires, notably those on our Broad Street trunk line, extending to the extreme western and northwestern limits of the city, the howling of the dynamo currents remained comparatively unabated. After further consideration I became convinced that the principal source of our telephone troubles was a long electric light circuit which traversed Main street to the western limits of the city, then crossed northward to Broad street, which it followed eastwardly to a point opposite the Power House, and thence in a southerly direction to the dynamos, thus making a loop about a mile and a half in length by a quarter mile in width. One side of this loop ran parallel with our Broad Street trunk line almost the entire length, with only the width of the street between them. I was at first inclined to attribute to the usual scapegoat "induction," the interference which we experienced on our Broad street wires; but my attention

being about this time directed by some of my linemen to the interesting fact which they had discovered; that even in the dryest weather enough of the dynamo current on this large loop escaped over the insulators and down the poles to be perceptible to the tongue when applied to a pole four or five feet from the ground, while in rainy weather a very perceptible shock could be felt by applying the hand to a wet pole.

My former opinions regarding "induction" vs. "leakage" and the "infinite conductivity" of the earth were recalled to me with redoubled force, and I soon settled down to the conviction that *leakage* was the foe with which I had to deal. This conviction was strengthened by the well observed fact that the interferences from electric light currents were greatly increased during wet weather.

But the famous Richmond Union Passenger Railway with its street cars propelled by electricity became a moving, flashing reality in January of the present year, and for a time rendered the telephone business in Richmond decidedly interesting. Unlike the electric light and power systems, the electrical plant of the Railway Company was not designed or arranged for metallic circuits, but was, and still is, operated by mixed earth and metallic circuits, the currents being carried to the overhead trolley wires by a system of distributing mains, supported upon poles on one side of the street, these mains being connected at frequent intervals with the trolley wire by short lateral wires termed "feeders." As operated in Richmond, the electric railway system requires a double line of poles, one line on each side of the street, for the purpose of carrying short non-electric wires which extend across the street, between each pair of poles. These are termed "supporting" wires and are designed solely to support the trolley wires at the proper height above the middle of each roadway.

MR. MCCLUER (interpolating)—These trolley wires are designed to furnish current direct to the motors in the cars by means of a trolley which in some systems rides on top of the trolley wire, and which in other systems, as is the case with the Sprague system in Richmond, rides underneath the trolley, where the trolley is supported on the end of a flexible pole attached to the top of the car, and then extending up underneath the trolley wire and revolving, of course, as the car makes its way over the track, the current then passes down through the motors, and then to the earth.

MR. LOCKWOOD—A single wire?

MR. MCCLUER—Yes, a single conducting wire.

MR. GIFFORD—And a bare wire?

MR. MCCLUER—A bare wire as a matter of course.

These supporting wires and the network of special supporting or curve wires whose office it is to cause the trolley wires to curve parallel with the curves in the road-bed are supposed to be insulated from the trolley and feed wires and mains, but, as we found to our cost, they were not by any means

devoid of electrical currents. During the first six weeks after the inauguration of the electric road we had eight sets of telephones and one central office annunciator drop, burned out by the railway currents, and about half of these accidents were due to crosses between our telephone wires and the supposed-to-be harmless supporting wires. While these accidents demoralizes our linemen and operators to some extent, they fortunately resulted in but little damage to property, and none whatever to human life, and but few of our subscribers learning of them, they created no special commotion.

But the effect of the railway system upon our central office apparatus and telephones from the very inauguration of the railway plant to the present time has been annoying in the extreme, and exceedingly detrimental to our exchange service. Almost the first revolution of the battery of railway dynamos tripped the annunciators of our magnetic lines and rendered necessary an immediate resort to the use of special armature springs to overcome the magnetism imparted by the currents from the railway wires. Our " testing off " galvanometers were rendered inoperative, because at first the polarity of the extraneous currents was opposed to that from our galvanometer batteries, and the galvanometer needles were deflected in a direction contrary to the position they assumed when under the influence of the batteries alone, the leakage from the railway wires being sufficiently strong to overcome the current from three cells of Law or Leclanche battery.

This trouble I remedied by reversing the poles of my galvanometer batteries so they would, with the exception to be mentioned, coincide in polarity with the extraneous railway currents. And this exception coupled, with the continuous and steady nature of the extraneous currents, confirmed me in my belief that it was leakage, and not induction from which we were suffering.

At the power house or dynamo rooms of the Railway Company, distant three or four squares from our central office, the battery of five or six dynamos which furnished the current for the car propulsion, was grounded, the negative electrodes being connected to several large sheets of copper at the bottom of a deep well upon the premises. The positive electrode of the dynamos (coupled up, of course, in multiple arc) being connected " to air," as a telegrapher would put it, or to the distributing mains. From all of our exchange stations located in the vicinity of the dynamo rooms, within the radius of an entire block in fact, we would, therefore, get a *negative* leakage current, while from all other stations, which were grounded within a square of the railway track and wires, we would obtain a *positive* current, thus rendering it impossible to arrange our galvanometer batteries to coincide with these leakage currents of opposite polarity.

We cannot, therefore to-day use our galvanometers for testing off the few stations located in the immediate vicinity of the dynamo rooms.

Identically the same effect was produced upon our head-phone test circuits, the railway currents completely neutralizing the currents from our " test " batteries.

This difficulty was also remedied by reversing the poles of the batteries.

The exchange lines most greatly affected by the railway currents we soon found, by experience, were those which were grounded nearest to the railway tracks, irrespective of the general direction of the wires or their proxmity to or

distance from the railway lines that in no place approached within less than a square of the railway wires being as greatly affected as many others that ran parallel with, and in close proxmity to, the railway wires for long distances, but which terminated, and were consequently grounded, at points comparatively remote from the railway.

Mr. McCLUER (interpolating)—We had a trunk line extending down Bank and Franklin streets, but on one side of those streets, while the railway mains occupy the opposite side of the railway, with the exception of the distance between Ninth and Twelfth streets. That was straight and rather narrow, and bordered on the north side by a handsome row of shade trees adjoining the Capital square. These trees our city engineer strenuously objected to our cutting or trimming for the railway wires. We were compelled to accede to his demand that we should allow the railway wires to be carried on the poles that distance from Ninth to Twelfth streets; yet the interference that we received from these railway currents was heavier on wires that did not run down Bank and Franklin streets at all, but which left the central office and went directly away from the railway two squares to Carey street, and down Carey street a mile or a mile and a half, and then north several squares, and grounded near the eastern terminus of the railway track. In those wires that did not run parallel with the railway wires at all, our interferences were heavier than with those wires that were strung on the same poles with the railway wires for those three squares.

In like manner lines grounded near the heavier grades and curves of the railway where the motor men are compelled to use the maximum amount of power in order to ascend the grades or round the curves with heavily loaded cars, are more seriously affected than lines grounded near the levels.

So clearly is this the case that our operators can readily tell from the character of the disturbance which they experience, when a car is ascending a grade, or when it stops or starts.

This effect of the movement of the cars you of course understand is due to the fact that the dynamo currents when propelling the cars, are short circuited from the trolley wires through the motor fields and armatures to the earth; thence spreading over every available conductor in their efforts to reach the dynamos. But the maximum disturbance is experienced when three or four cars are following each other in close file either on a grade or a level. In that case the leakage due to each car traverses the contiguous telephone wires simultaneously, producing in our telephones a composite or mixed tone, each motor having its

distinctive timbre or tone quality, and all united, fairly making Rome—or the telephone rather—howl, and drowning out the puny currents induced by our microphone batteries.

Learning that the railway people were utilizing the muncipal gas and water mains in order to reinforce their ground connections, it occurred to me that possibly the fact of our lines being generally grounded on the gas and water pipes had much to do with our troubles, I had some of our wires removed from those systems and connected direct to the earth through made grounds, but without altering the result.

The 450 or 500 volt currents of the railway mixed circuit system do not, however, interfere as greatly with our Richmond exchange service as the 4,000 or 5,000 volt currents carried by the metallic circuits of the electric lighting systems. Did the railway service require currents of the same E. M. F. as the arc lights the telephones would have to retire from the field—lose ground in fact—as metallic circuits would be their only salvation. What the railway currents lack in E. M. F., however, they make up in current strength, and are therefore more dangerous to property than the much more intense electric light currents. The latter will melt a fuse or burn out an arrester instantaneously, before time is given it to enter a central office or a subscribers' station, and damage the telephones or outfits, while the less rapid but larger quantity of the railway current takes an appreciable time to melt or fuse an arrester, thus permitting it to burn out a hand-phone, an induction coil, or a bell or annunciator magnet, before the protector, of whatever kind it may be, can properly act.

In *my* experience the greater tension of the electric light currents renders them doubly disastrous to a telephone exchange service. The voice being more completely drowned by the intense disturbance due to the electric light escapage, than it is by the escaping currents from the lower tension railway dynamos. But the fact of the electric lights being in demand, particularly the arc lights, only after business hours, renders the disturbances engendered by them less noticed by subscribers generally, than the weaker and less marked disturbances proceeding from the railway generators, which are continuous throughout the entire business hours of the day, when the telephone service is in constant demand. Did the arc light service continue during the hours of daylight as at night, telephone exchanges would be compelled to suspend operations or adopt the only alternative, metallic circuits, with the attendant increase in complication and expense.

MR. MCCLUER—(interpolating) I say in *my* experience. As a matter of course, in larger cities where there are a multiplicity of electric lighting systems with power houses distributed at intervals all over the city as it were, and with a multitude of circuits and currents going backwards and forwards and neutralizing each other by being carried down in one direction on one of poles, and in another direction on another line, of course the disturbances are not as great as

in a small place like Richmond, where the currents are all in one direction and on one line of poles, as is the case with this large circuit.

Having thus discussed the effects of extraneous electric light and railway currents, let us address ourselves to a brief consideration of the remedies which we have at hand. Anti-induction devices for the elimination or exclusion of extraneous currents from telephone circuits, whether they be artificial or natural, are plentiful, but none have yet been devised that can at all compete with the old style metallic circuit.

But the metallic circuit exchange system carries with it not only a double expense for construction, maintenance and repairs, but a vast outlay and increased complication and expense for central office plant and service, there being two line wire terminals to provide for every subscriber, and necessarily four terminals to handle for every connection, instead of two, as with the single wire and earth system.

This great increase in wires, in complication and consequent liability to derangement, and in initial cost and subsequent expenses for operation and maintenance, almost prohibits the adoption of the ordinary metallic circuit systems. None but the wealthy like our long distance friends can afford such a luxury. But there *is* a metallic circuit system within reach of even the poorest of the American Bell Company's lessees, a system of my own devising, and which I have found by practical tests to accomplish all that can be derived from an ordinary metallic circuit, and but at a tithe of the expense.

Recurring now to my theory that it was not "induction," but leakage, that annoyed us, and the expression of my disbelief in the infinite conductivity of the earth, it will readily be seen how, after arriving at those conclusions, I would very naturally reason thus: If our telephone troubles are due to leakage from the electric light and railway wires, and this leakage overflows into our wires from the earth, *because* the earth offers an appreciable resistance to their passage, why cannot we adopt a metallic conductor of exceedingly low resistance, or of a conductivity approximating that of the earth, and use *it* in place of the earth as our return conductor, making it in fact what may be called an "artificial" earth or ground, and at the same time cutting loose from the earth entirely and gaining all the benefits of metallic circuits?

This idea I conceived to be in strict conformity with Ohm's law, and if only the relative resistance of the "artificial ground" or earth and the line wires attached to it were properly adjusted, we would have identically the same results achieved by the usual earth connections, and without the disadvantage of the mixed circuits. This thought revolved in my mind for some months before I could find time and opportunity to verify its truth or falsity by experiment. Besides the device was so simple that I could scarcely conceive that it was possible it had not already been tried and found to be impractiable, by some member of the army of electricians that had been so long engaged in efforts to solve the anti-induction problem; and it was only after conferring with some of my brother telephonists, who were favorably impressed with the idea, which was novel to them, that I took the time necessary for experiment. I, however, finally connected up several

telephone circuits with a common return wire of low resistance, and found that conversations could be carried on, and the magneto call bells rung on each circuit, without any mutual interference whatever, and it required a resistance of 35 ohms by galvanometer measurement to be added to the common return wire before the currents propagated in one circuit could be heard in the telephones on the other circuits. I thus concluded that there was approximately 350 ohms resistance in each circuit, due to the conducting wire, the call-bell magnets and the hand phones and transmitters, that the "artificial ground" wire should bear to the other side of each circuit, the direct or line wire, a resistance approximating one tenth that of the entire circuit.

Encouraged by this experiment, and anxious to do something to improve the night service of my exchange, I laid my scheme before the executive officers of my Company, and was furnished with a half mile of No. 4 covered copper wire, with which to make some practical tests.

My first experiment was with our No. 19 nothern call wire, and its connecting lines. This was our shortest call wire, being only a third of a mile in length, and had connected with it some 18 or 20 subscribers' stations, located in close proxmity to the Seventh street grade of the electric railway, an 8 or 10 per cent. grade, extending from Franklin to Grace street, one square.

At the corner of Seventh and Franklin streets, the main feed wires of the railway plant direct from the power house, two squares distant, first touch the line of the railway, and divide right and left to the opposite and distant ends of the road. At this point, as might have been anticipated, and on our telephone lines grounded in this vicinity, we experienced the greatest interference, particularly when a heavily loaded car was ascending the hill. My "artificial ground" gave us immediate and remarkable relief from the railway leakage, and without any cross-talk whatever. I then applied for a half mile of No. 6 covered copper wire, which I connected to the end of the first half mile of No. 4 wire, and extended my artificial ground wire on out to the western end of the city, intending to make my next test with one of our longest taps and our longest lines, with stations located near the most westerly extension of the long Main and Broad street electric light loop of which I have already spoken. These lines had been almost entirely abandoned at night, our subscribers averring that they could not use their telephones at all after the electric lights were ablaze.

The worst of all was a station in a drug store whose proprietor had long made bitter complaint that his telephones were of no service to him whatever after dark. Yet when the change was made from the natural to the artificial ground at this and all other stations on that call wire tap, the relief from the electric light leakage was as instantaneous and marked as that experienced from the railway leakage on short tap No. 19.

In fact such was the change wrought on these wires that it was possible to carry on a whispered conversation over lines connected to my artificial ground, that when connected to the natural earth were so noisy that even the loudest shouting could be heard only with extreme difficulty.

While cogitating over my idea in its incipiency, it occurred to me that even the adoption of a *general ground wire* of high conductivity would relieve our telephone wires from the influence of these extraneous currents to a great extent. This I found from experience to be true.

When arranging for the "Central Office" end of my "artificial ground," I had made a plug-switch, so arranged that by the insertion or removal of a single plug I could connect the artificial ground wire to earth, or disconnect it entirely from the earth, and with one motion connect it with all of its attached wires into a "compound metallic circuit system."

I could thus readily note the difference made by the use of the large copper wire as a *general ground wire*, or as a substitute for the earth.

In the one case, as you understand, if I have made the matter clear to you, the large copper wire was connected to earth at only one point through the plug-switch in the Central Office, while in the other it was disconnected from the earth entirely.

MR. MCCLUER (interpolating)—For fear I have not made this perfectly plain, I will interpolate here in a little stronger language, if possible, the difference between these two arrangements. In the one case, using this large common return wire of large conductivity as a general ground wire, you will understand that all the stations on the route followed by this large common return wire were disconnected from the earth entirely, and the ground pole connected to this artificial earth instead, none of the subscribers' lines or stations being connected to earth at all, but all of them on the current generated by the microphone batteries seeking ground from this general ground, by the ground in the general office. But by means of this plug I have arranged, I could at any time I chose to, make such an experiment—by withdrawing this one plug I could detach this general wire from the earth entirely, so that I had a system of purely metallic circuits, no earth connection whatever.

MR. DURANT—Allow me to interrupt you one moment. You say you disconnect by means of a plug from the earth. Now what was it that connected it at the central office?

MR. MCCLUER—I had one of the operators' head-phones connected to that instead of the earth, and I also had one of the operators' sets of telephones in the central office connected to that in the same way; so that by putting the taps that had been changed from the natural to the artificial ground all on that one head-phone I could place all those stations on one operator, or I could put it on my own ear so that I could receive all the orders given by subscribers over the metallic circuit. There is no ground connection at all;

the central office operator's head-phone and this operator's telephone and transmitter being connected to the other end of the artificial ground, and of course connected inside, we may say, of the point at which the ground wire was connected on; there being two plates, one heavy brass plate to which this artificial ground and the telephones were connected, the other plate having nothing attached to it whatever, but the wire leading to the natural earth. As a matter of fact, when the plug was in there, all these connected stations got earth through this plug and ground wire, and when the plug was disconnected, they were all disconnected from the earth.

MR. LOCKWOOD—Then, Mr. McCluer, the subscribers' lines were connected at the subscribers' stations. Instead of each of them being connected to its individual ground wire, a group were connected to one large return wire. Then, was the central office end of the large return wire connected to the central office ends of the individual wires when you took your plugs out?

MR. MCCLUER—No, sir; it is left open. You understand that we, the Southern Bell Telephone and Telegraph Company, are exploiting the Law system; we do not use the magneto, and of course we have no grounds on our wires in the normal condition at all. When the line is not connected to another line, there is a ground at each of the subscribers' stations, but none at the central office end.

MR. GIFFORD—That would not work in the magneto system.

MR. MCCLUER—It would work in the magneto system, if you took the subscribers' lines and connected them to this artificial ground. It is just as though you were taking a strip of earth, extending the whole length of your route, and digging that up and lifting it on your poles. In other words, you look upon this wire in exactly the same light as you look upon the ground.

MR. GIFFORD—If you should cut your exchange wire and connect that to your return, what would be the effect? Have you experimented on that? In your Law system you have no ground.

THE PRESIDENT—I think the Association would prefer that Mr. McCluer should read his paper first and then questions can be asked of him afterwards.

MR. MCCLUER—I think it probable that what I have to say further may throw a little more light on that point.

To those familiar with the details of a telephone exchange, it will be clear that some such provision for grounding or connecting the artificial ground to mother earth is essential, as long as any of the wires of the system remain in connection therewith, because of the necessity of connecting stations not yet changed to the artificial ground, to those that have been thus changed, otherwise the one will be grounded and the other "dead open" and consequently inoperative.

MR. MCCLUER (interpolating)—So I take this number nineteen tap, connect that into an artificial circuit by itself. I might put that on a single head-phone and let one opertor wear that. She would get all the orders over the call wire with perfect distinctness and without any trouble whatever, but when she went to connect a subscriber on that call wire to another subscriber in another quarter of the city, whose station was still connected to mother earth, of course we would have the case I mentioned here. The station of the subscriber that had not been changed to the artificial earth would be grounded, the other station would be dead open, and of course there would be no chance of any conversation except through the leakage that occurred through the pole. When my experiments were in progress I would receive an order from a subscriber on this metallic circuit; I would repeat it to one of the operators, and the two subscribers would be carrying on a conversation; but the first thing said would be, "What is the matter? You sound as if you are a thousand miles away." They would get distinct articulation, but in a much weaker tone.

In this way I found by experiment that when the large copper conductor was to earth at the central office, and being used simply as a general ground wire, the electric light and street railway interferences were reduced about 50 per cent., and when used wholly detached from, and wholly in place of the earth, they were reduced the other 50 per cent., or eliminated entirely.

MR. MCCLUER (interpolating)—You understand that when this general return wire was used as a general wire, all of

the wires on such a tap being connected to this one ground wire, and all seeking earth at the central office instead of at the point where the subscriber's station was located, it reduced the interferences from street railway and electric light currents at least fifty per cent.; so that where it was only with difficulty that you could make a man understand what you said, with this general return wire we can hear very well indeed.

MR. GIFFORD—That general ground wire was grounded in the central office?

MR. MCCLUER—Grounded in the central office. But when made wholly detached from, and wholly in place of the earth, they reduced the other fifty per cent., or eliminated it entirely. On those stations I spoke of before, the leakage from the electric light wires had been so strong that the subscriber could not use his telephone at night, and the operator could not hear him with distinctness when he ordered a connection. Therefore he told me he never thought of using his telephone after the electric light had been started. As soon as I had this tap connected to one of these artificial ground connections I sent one of my inspectors to make some experiments. He called me over this general ground wire. The operator heard his order to connect with 180, which is the chief operator's telephone in the central office. I went to the telephone and talked with him without any difficulty at all. Then I removed this plug from the switch and converted that ground wire, with all its attached wires, into a metallic circuit, and he and I then carried on a conversation in a whisper, of course getting close to the transmitters, as you have to do under those circumstances. But I just mention that to show you the difference between the general ground wire and the metallic circuit. Then when I made him take out the general ground wire and replace the old natural wire, the din from the electric light was so great that he could not hear a word. I then called the subscriber to the telephone, and the very moment I spoke to him he said: "Hello, what have you done here?" I told him I had been experimenting to see if I could not relieve him of the

trouble he had been complaining of. He said. "You have done it." I then took the plug out of the central office, disconnected the earth entirely and talked to him over the metallic circuit. He then expressed still greater wonder that the electric light interference was gone entirely; he could not hear a sound of it. I then made some remark in a whisper which he heard without difficulty, and replied to me in the same way.

By thus utilizing the large conductor, first as a general ground wire to carry the microphone or signaling currents ——

MR. MCCLUER (interpolating)—Now, of course, in practice it is much more convenient to have this general ground wire, as I ought to call it now, grounded at the central office. It is more convenient to do it for the purpose of manipulation, but the same effect would be produced if this general ground wire was carried to any other point in the exchange and grounded at a point remote from the railway or electric light plant.

By thus utilizing the large conductor, *first* as a general ground wire to carry the microphone and signaling currents to the earth at the central office, or at any other locality remote from the offending electric light or railway plant, an exchange system can be gradually converted from a mixed metal and earth system into a compound metallic circuit system throughout, without any interference whatever with the service of the exchange, and to its manifest improvement during the time the change is being made. And when the last subscriber's line has been transferred from the natural to the artificial earth at the *last station*, it is only necessary to withdraw the solitary plug that still connects the system to the earth and, presto! you have an exchange of purely and practically metallic circuits alone, with *all* of the advantages, and without *any* of the *dis*advantages of the ordinary metallic circuit systems.

The one series of large copper wires extending out on the various trunk lines. but all united in one at the central office, answering fully the purposes gained by the ordinary duplication of each individual wire, and necessitating no change whatever in either central office or station outfits or appliances beyond the simple substitution of the artificial for the natural ground.

In practice it may be found that a greater proportion than one.tenth the resistance of any one circuit may safely be given to the "artificial ground wire," but my experience and experiments lead me to believe that it will be far safer and more satisfactory to keep the resistance of the "artificial ground" down to one-twentieth that of the entire circuit.

MR. MCCLUER (interpolating)—In any exchange circuit

you have got wires of different lengths from one-sixteenth of a mile to two or three or four miles. I allude now to the wire of lowest conductivity. This artificial ground wire should bear to any direct wire, whatever its length may be, the ratio of one-twentieth of the resistance of the individual line, that making it advisable that the wire nearest the central office should be of large conductivity. Then as you go farther from the central office you may use a smaller wire—a number six; still farther, a number eight; still farther, a number fourteen.

In an exchange, the size of our Richmond exchange, I advocate the use for each individual trunk route of a single copper conductor, composed of a half mile each of No. 4 and No. 6 wire, with No. 8 for lateral lines, and the remaining distance to the farthest stations, with No. 14 to stretch from the poles into the stations. All of these wires should be of hard drawn copper with a good covering, and strung on the same poles and fixtures that carry the regular exchange wires, but insulated carefully both from them and the earth And I should place these artificial ground wires at the lowest point on the poles, or the least distance from the sidewalk or ground, beneath all of the line wires, if possible.

In this position the small amount of leakage currents that are attracted up the poles from the earth, whether from electric light, electric railway and power circuits, or earth currents, will be intercepted by the large copper wires, and by them carried to those points in the system where they will escape to earth again without any adverse influence upon the telephone wires proper.

McCLUER (interpolating)—Now, in my experience, a great deal of the leakage we get from these extraneous currents comes from the leakage of the insulators and poles of the railway plant. With this wire it would be apt to intercept and carry all of these currents to earth at some point where they would be naturally disposed to go to earth in order to reach the other electrode of the source from which they emanate.

While in the absence of any direct experiments I cannot say positively that such will be the case. I, however, believe that if our long-distance friends will couple together so as to make of some 8. or 10. of their No. 12. or 14. copper wires, practically a single low resistance conductor, they will find that this compound conductor will answer as an "artificial earth" or return wire for treble or quadruple the number of wires thus coupled together, while a single conductor of the same conductivity would double the capacity of their poles and the number of their metallic circuits.

MR. MCCLUER (interpolating)—This is a matter of theory, but I am satisfied that if the comparative resistance of this artificial ground wire is kept sufficiently low below the resistance of the other wires, that it is practicable.

In like manner I believe the same principle can be applied to telegraph and electric light or power circuits, relieving them from the disturbing and damaging influences of earth currents and atmospheric electricity, and conferring upon them all the advantages of metallic circuits without the ordinary duplication of wires.

In conclusion, allow me to say that while I flatter myself that I am charitably disposed, and ever inclined to do all that within me lays to further the interests of the telephonic fraternity, and increase the efficiency and value of our telephone service, I do not think I am justified in assuming the role of a public benefactor and giving my device away, even in the interests of science. Believing it to be novel, practicable and valuable, I have therefore conceived it to be my duty, as well as privilege, to apply for a patent, and my application is now pending with, I trust, a good chance for a favorable decision.

C. E. MCCLUER.

THE PRESIDENT—Before entering into a discussion of the paper read by Mr. McCluer, I think it would be advisable to hear Mr. Lockwood, whose paper is, relatively, on the same subject, viz: "The Electrical Relations of Telephone and Electric Light and Power Circuits and Railways."

MR. LOCKWOOD—Mr. President and gentlemen: If Mr. McCluer will permit me, I would like to ask him one question, and that is, Whether he has made a point of having his return conductor parallel with his main lines?

MR. MCCLUER—Of course, sir; in every instance; I have only, so far, in the Richmond exchange provided only one common return wire, that is up Ninth and Broad streets, and up Broad street to the western extremity, with branches radiating along the lateral lines. Of course, this wire is carried on the same poles and parallel to all the wires connected to it.

MR. LOCKWOOD—I would like to state, gentlemen, that I did not know Mr. McCluer was going to read a paper on this subject, or perhaps I should have chosen a different one; but when you hear mine, you will perceive that there is no collusion between us.

He is quite right, I think, in attributing a certain amount,

at least, of the disturbance, and perhaps nearly all the disturbance occurring from electric railways to absolute leakage of the electricity from the rails to the telephone wires; but like nearly every person who has at one time adopted one theory for certain phenomena, and at another time another theory, I think he has become an extremist, and, as is usual, the mean is the correct view. A great deal of our disturbance on telephone lines is still due to the old enemy—induction, and although the telephone business is now eleven years old, induction is still just as strong as it ever was. The troubles that electric lighting and especially arc lighting have given to telephone men are of two-fold character; first, of the character which disturbs the conversation; and secondly, of the character which destroys the wires and apparatus. Within the last year or two we have become apprised of another enemy in the lighting camp, namely, the alternating current used for incandescent lighting, and these are used not only through converters but also on direct circuits. The telephone line which runs from the Malden central office in Boston to my own house is a very much disturbed line indeed, and I allow it to remain there so that I can study the phenomena. But we formerly had a Thomson-Houston direct arc lighting machine with a three-plate commutator, and the noise was bad then; but lately they have taken to lighting Melrose, where I live, with incandescent lamps placed in a direct circuit and operated with an alternating machine, and the noise is now tremendous, because the alternations are almost as quick as the telephone alternations, namely, about two hundred per second.

I will now proceed with my paper.

ON THE ELECTRICAL RELATIONS OF TELEPHONE AND ELECTRIC LIGHT AND POWER CIRCUITS AND RAILWAYS.

This paper deals altogether with the disturbing effects of electric light and power currents upon telephone lines, and not at all with the dangers of imperfect construction and insulation; nor with the results and prevention of dynamo current crosses, there being sufficient in the latter branches of the subject for a separate and equally voluminous paper.

It will consequently be assumed for the purposes of this paper that the important precaution of effectively insulating wires conducting heavy currents is observed, and that "undertakers' wire" is, as it ought to be, a thing of the past.

The Telephone Exchange business was commercially organized and established in the first months of 1878.

Electric lighting as a commercial industry had its beginnings in 1878 and 1879, but did not at first take root with the same degree of rapidity which characterized the exploitation of the telephone, and not until some years thereafter did it achieve popularity.

Consequently the telephone systems obtained a considerable start, and were firmly established in nearly every city and town in the country before the organization of many electric lighting systems. It was not at the outset generally known that the telephone circuits would be annoyed by the presence and proximity of parallel electric light wires; and telephone companies were thus at first most liberal in permitting the erection near their lines of foreign lines carrying heavy and widely fluctuating currents.

Yet a little thought and consideration would have laid bare this danger. We knew that the telephone current was itself of the most shadowy and almost intangible character in point of strength, and that to utilize it, such a supersensitive instrument as we all know the telephone to be, was actually essential; and we knew that *because* the telephone receiver was such a delicate electroscope, and so sensitive to electric motion, we had heretofore been much annoyed by mutual telephone induction; by telegraphic induction; and by miscellaneous induction. So as I say, if we had carefully considered the matter, we might have foreseen the full extent of the electric light disturbance, which is now being sustained.

But we did not foresee, and as a result of our lack of our foresight, indiscriminate construction has ensued; and in consequence of improper construction the business of many telephone companies has, at certain points, been directly or indirectly injured by the presence and operation of electric light wires, and an appeal to the courts has been rendered necessary.

Until within a comparatively recent period the disturbance resulting from dynamo current induction was, with an occasional and rare exception, limited to certain evening hours and to the night, because during such portions only of the day were the lighting circuits in operation. But of late, in many places, the wires used in the night for lighting are being also used during the hours of daylight for transmitting power from the dynamos to large numbers of motors which may be widely distributed; and as this utilization is certain to have in the near future an enormous expansion, we are compelled to face the prospect that even during the hours of business, telephone wires are now liable to severe disturbances; therefore it seems time to call a halt; we could be patient as long as we are only called upon to suffer from "the pestilence that walketh in darkness," but when we are also threatened with "the destruction that wasteth at noonday," it behooves us to have something to say about it. Superadded to the above causes we now find that electric railways are being introduced in rapid succession, and we find to our cost that many of them are much more active than are electric lighting circuits in setting up distributing currents in telephone lines; the

disturbing current from electric railways being frequently sufficiently strong to vitalize the annunciator magnets of a telephone central station, and to actuate the drops.

Now I have no quarrel with electric light and electric railway companies considered as such. No man rejoices more heartily than I in the triumphs of electricity, and in the tremendous spread of its usefulness; I recognize fully, moreover, that the lighting, power and transit utilizations of this mighty form of energy are fully as useful as is its function of carrying intelligence; and that these utilizations have properly become permanent institutions, and equally with our own public convenience. Nevertheless we were first in the field, and although we may admire both the energy of the electric lighting current and the energy of its introducers, we must in our own defence be prepared to take the position that no newcomer has a right to construct his plant in such a way that an established business shall thereby be ruined or impaired; and that if it be absolutely necessary to erect electric light lines in proximity to telephone lines, the construction must be of such a character as not to involve detriment to the pre-existing telephone lines.

Can electric light and power lines be constructed so as to be near telephone lines without interfering with them? Certainly they can.

Consider how the disturbing currents originate. *First*—Most arc lighting currents can set up considerable induction on telephone lines.

Second—Alternating currents in main wires, whether used for arc or incandescent lighting, are intensely provocative of induction and noise in telphone circuits; the character of the disturbance being much worse than that which is produced by lighting currents of constant direction; this latter sounding in the telephones like a protracted musical note of great volume.

In speaking of the above it will be understood that the detrimental action upon telephones is the same when the dynamo current is used for motors as it is when used for lighting.

Third.—Certain classes of electric railways very seriously interfere with the operation of telephone lines, both in conversation and also by establishing thereon a current which permanently excites the annunciator magnets. The noises which are produced in telephones by dynamo currents induction are so well known that it would be waste of time to describe them.

When the troublesome currents are produced by electric light or motor circuits they may usually be attributed to induction, although a certain amount of absolute leakage doubtless also exists. Since, however, both causes produce in telephone circuits a like effect, it will be sufficient to speak of induction only. But if we consider the action of electric railways upon telephone lines, we find that the major part of the disturbance is due to the actual transference of a portion of the electricity which actuates the train motor to the telephone lines, by way of the rails (when these are used as return conductors), the crust of the earth itself and the telephone line terminal ground wires.

As most of us know, the alternating current has received lately an increasing amount of the patronage of our light-producing friends; and at the present time both constant direction and alternating currents are largely used in electric lighting and power distribution circuits, the intensity of the disturbance varying with the class of current employed.

The violence of the induction, and therefore of the disturbance, depends upon the proximity and longitudinal distance of parallelism of the disturbing wire; the strength of the inducing current; the frequency or rate of change per time unit of the inducing current; and the extent or range of such change; that which is due to wires carrying alternating currents is of course much stronger than even the worst case of direct current induction; for even though the distance of exposure, and the strength of the inducing currents be identical, it is self-evident that a current which is completely reversed a great number of times per second, must be much more energetic as a disturber of the peace than one which is constant in direction and which varies only in strength on one side of the zero line.

These considerations indicate that our methods of prevention or cure should be directed at the stronger disturbing agency, since such a degree of success as we may be able to achieve against that will necessarily be equally effective as regards the weaker.

The proper way to cure or neutralize electric light or power induction *is to prevent it.* It is quite within the bounds of good construction so to relatively arrange lighting and telephone circuits that no disturbance will result; and it is obviously much easier and less costly to construct them properly in the first place than it is to change them. To secure this most desirable result, viz: the harmonious co-existence of these widely differing classes of electric service, I wish to point out that co-operation between the parties concerned is absolutely essential, together with a clear and full understanding of the conditions involved. Yet in too many instances, though as I have stated, the telephone wires were already in the occupancy of the field, telephone companies have negligently omitted to watch their own interests with sufficient care, and have without remonstrance permitted electric light companies to erect wires close to their own, and of such a character as to render inductive disturbance a foregone conclusion. Would not a general good understanding between the different electrical interests of any city or town be desirable for the forestalling of such chances of future disagreement? Informal discussion, amicable conference and mutual consideration between the authorities of the several interests would tend to preclude any possible future misunderstanding, and would certainly act to prevent unnecessary antagonisms either between any of the several individual interests or with municipal authorities.

A good understanding all round is, therefore, suggested as being an admirable forerunner to a system of non-conflicting construction.

Local managers of telephone companies should be instructed to report to headquarters at once the intended construction of either electric light or railway circuits at any point within their territory, so that proper measures can be concerted and adopted to meet the special conditions of the case.

If the general satisfactory understanding, which I have outlined, can be reached, it should not, I conceive, be difficult to bring intending electric light and railway officials to see that construction, which is innocuous to their neighbors, and which in virtue of the provisions necessary to secure such innocuousness is thereby made safer in all respects, is (all things considered) both cheaper and better than construction, which is at any time liable to involve them in trouble, misunderstanding and damages.

The element of distance is of the highest importance. Telephone and electric light wires cannot be too far separated for the efficient working of the former; and the wires last strung should be run, if possible, on other streets from those in which wires are already in operation. In no case ought the two classes of circuits to be nearer together than the width of an average street.

In writing the above I have not forgotten that it is oftentimes a matter of mutual convenience that reciprocal privileges shall be allowed. This idea is by no means in conflict with the general principle that distance is the most efficient neutralizer.

The good feeling and understanding which I have advocated will be productive of a tendency to keep down unnecessary pole construction, and if either interests have a pole line through a certain territory, and if the other party have but a few wires going in that direction, it is doubtless often the best policy and practice to make the existing pole line available for both. By suitable agreement on this head, both telephone and electric light systems are enabled to use each other's poles on occasion, and thus to carry a sporadic line and accommodate a customer in districts which could not otherwise be reached, at least with due regard to economy. It is, of course, understood that an electric light company thus stringing wire on the poles of a telephone company, must properly run its wires so as to produce at most a minimum disturbance; and that a telephone company taking its chance on electric light poles must not expect first-class results, unless it be returned through the region of disturbance. The responsibility in the latter case is on the owner of the telephone wire alone.

If both sides of the street be fully occupied, and it should be really necessary to carry a main route of wires of both systems on the same side of any street, no other street being available (a state of affairs which ought not often to exist), it would, I should say, be better for them to be upon a single line of large poles, than for each company to provide its own poles, and thus to incur the enmity of abutters, property holders, municipal authorities and iconoclasts generally, for a uniform style of construction can then be adopted, and as the telephone current is the weaker, the telephone poles should carry both sets of wires, and the construction should be supervised by its officials. This procedure is, however, only admissible if no other route can be found for the wires of that concern arriving last on the ground; and I repeat, that wherever circumstances will permit, the width of an ordinary street, at least, should intervene between the wires of the two systems.

Electric light and power circuits ought always to be metallic; and in fact every self-respecting electric light circuit is metallic; this, however, being altogether without regard to its relations with contiguous circuits of other classes.

But a lighting or power circuit which is contiguous to telephone circuits must not only respect itself, but must respect the telephone circuits also, and hence must not only be a metallic circuit but must have its two wires parallel and as close together as possible, so as to be practically equidistant from the telephone wires; this, in order that the inductive effect exercised by the outgoing and incoming wires may be equal and opposite.

Where the distance of the width of the street is observed the parallel return wire frequently provides all the necessary neutralization and prevents distur-

bances, for the neutralization is necessarily more perfectly effected, as the distance of the two wires of the electric light circuit from the telephone wires is increased; because the distance of the two wires of the lighting circuit from one another is a much less factor in a greater distance such as the width of a street, and the two wires therefore operate much less independently than is the case when each wire is almost as near to a group of telephone wires as it is to its own mate. It is, however, often also found (and especially when the two sets of wires are on different horizontal planes of the same poles) that even though the two wires of the lighting circuit be substantially equidistant from the telephone wires, perfect neutrality and noiselessness is not secured; and the degree of remaining disturbance is greater or less according to the distance between the wires of the two systems, and the distance that the said two sets run in parallel contiguity. This remaining disturbance manifests itself, because the electric light circuit is not balanced. If, for example, one of the two sides of a lighting circuit be made to serve one or more lateral loops, while the other runs straight; or if one be connected with a greater number of lamps than the other, there is no balance; the electrical center of the main line does not coincide with the mechanical center, and one of the two wires exercises a much greater inductive influence than the other; the result being *noise*. By arranging the electric light circuit so that each side shall have an equal number of loops of like length and an equal number of lamps or motors, and then by transposing or crossing the two wires of the lighting circuit about every fourth or fifth pole, the disturbance may be totally suppressed.

Such care in construction will most naturally be objected to by electric light and similar companies, on the plea of expense, especially by such as have already constructed their lines in a style regardless of the rights of others; yet only by an insistence upon such conditions when the two systems of lines are in close proximity, can the business of telephone companies be protected.

MR. LOCKWOOD (interpolating)—If we read Scottish history we find an incident took place when a certain number of Scottish noblemen took counsel how they could best limit the power of the king—James the Third, I think it was—and they evolved several very fine plans indeed; but nobody could see how they were going to work those plans, and one of them told the well-known fable of how the mice took counsel how they could bell the cat, and the one who undertook to bell the cat was known by that name afterwards. It may seem that these recommendations about the electric light and power circuits have very little to do with us, but my experience is that throughout the land electric light men have a very great deal of respect indeed for the opinions of telephone men. In many cases where there has been noise and disturbance of the wires I have heard these electric light

men say, "If you will show us what to do we will do it," and many have been perfectly willing to adopt any means to prevent disturbance if we will guarantee that when they have done what we recommend, it will stop the disturbance.

It may also be objected, that since the parallel return wire, cross-connected at intervals with the outgoing wire, is a remedy for inductive disturbance, it is one which should be applied by the telephone companies, and to the telephone circuits, as being the complaining party. But as to this in addition to the already stated fact, that in nearly every case where the pernicious effects of induction are experienced, the telephone company was already in business, and its wires in place; and that the disturbance originated with the advent of the electric light wires; and that common justice requires that the aggressor should apply the remedy, it may with reason be rejoined that the number of the electric light wires is much less than that of the disturbed telephone wires, and, therefore, the remedy may be applied to the former with much greater ease, and at much less expense.

We have considered the preventive or remedial measures which are applicable to this evil; and it seems clear that the right time for suggesting the propriety of observing these conditions of neutral construction is before the work has been done; and it is probable that the owners of disturbing wires will be much more willing to heed them in originally arranging their wires than where subsequent alteration is required; especially as in original construction the plans suggested would not necessitate the numerous joints inseparable from latter transpositions.

In any case, whether such remonstrance and suggestions as may be offered tending to harmless construction be properly received and acted upon, or not, it is our duty to offer them, and so to place ourselves in the right, and in the unmistakable position of having at least done our part in objecting to *improper*, and in stating our convictions of what constitutes *proper* construction.

I have already alluded to electric railways, and to the fact that the weight of the evidence in regard to disturbances developed by them upon telephone lines tends to show that these are due not to induction, but to actual conduction of electricity from the railway conductors to the telephone lines.

There are several classes of electric railways.

1. Those which utilize the rails for both outgoing and return conductors.

2. Those which employ a single overhead conductor using the rails as a ground terminal or return.

3. Those in which the two main conductors are both in a conduit, to which access is had through a slit, in the same way as a mechanical cable road is operated, trailing brushes or springs being led through the slit.

4. Railways which carry their own electrical energy in the form of secondary battery cells.

5. Railways which employ two overhead conductors; one as the outgoing, and the other as the incoming line.

Of these plans, the first and second are very detrimental to the satisfactory operation of telephones lines; the fourth is perfectly harmless in all respects; and the third and fifth usually are also and may be readily so made; when they

are not, all that is necessary to that end is to exercise such care in construction as to ensure that the main conductors are properly insulated, and in the case of the fifth plan that the main conductors are also prevented from coming into contact with overhanging branches of trees.

A great number of electric railways are built upon the second plan; and where they run near telephone lines invariably exert a pernicious influence thereon, which is largely due to the imperfect return or earth terminals furnished by the rails; a portion of the current passing from them through the earth to the telephone circuits by way of the sub-station ground wires, this occasioning interference with conversation, and affecting call signal apparatus, and often damaging property.

This class of construction is manifestly improper, both on the score of interference with the telephone wires, and as being dangerous; and is of the cheap and reckless order.

When the remedies for its evils are so simple, and consist merely in adding a second overhead conductor, and in looking well after insulation, it would seem that they should be promptly and universally applied by reason of the greater security they afford, even though those owning railways may have no just regard for the rights of others.

Telephone companies should, therefore, exert themselves and their influence in favor of the double overhead wire and other safe forms of railway: the former being in fact safer in other respects, and more economical in operation than railways, which in any way utilize the rails as conductors.

Where other systems are already in use, and should it be found impossible or impracticable to persuade the railway company to provide a return wire, and where the telephone service is consequently impaired, the only absolute and radical remedy is that of providing the telephone circuits which are affected with a parallel return wire.

The disturbances may, however, be greatly softened down or subdued by carrying the ground end of the subscribers' wire from his office or house to some point at a considerable distance at one side or the other of the railway, and by there terminating it, instead of at the sub-station itself. Considerable success has also been attained in practice in the amelioration of this trouble by connecting the leading out wires of a number of neighboring disturbed telephone lines with a large common return wire grounded at or near the central station, instead of grounding each in the ordinary way.

If the leakage is so great as to affect the annunciators, it is sometimes requisite that the common return wire instead of being grounded shall be connected with the several central office terminals of its group of lines exactly in the same way that its outer end is united to the outer ends of the individual lines; that is, of course, when these are at rest. By adopting this plan the earth connection is, when the lines are not in operation, completely cut off. If the disturbance does not affect the talking, ground connections can be provided for use during talking. If it does, then the return must be retained during talking also.

Though this paper is already long, there are still one or two points on which I should touch: In one of the children's hymns composed by the late lamented Dr. Watts occurs these lines:

" One sickly sheep infects the flock,
And poisons all the rest."

And upon the principle thus enunciated, it not infrequently happens that though but few telephone wires, or even but a single wire, be exposed to disturbance originating in and by the causes recited, the trouble is propagated to others by induction by reason of the close massing of large numbers of wires at or in the vicinity of central stations.

Consequently, one wire adversely affected by electric light or railway disturbance may influence deleteriously many others.

The lessons we have to learn from this are that if we have *one* wire so affected we ought in some way to promptly attack the evil in that one wire, remedying the trouble while it is small and controllable; and that it is essentially our duty to remove dead or unused wires at once, unless there is good reason to anticipate an early resumption of use; and even then they should be disconnected from the two terminal stations, and when I say disconnected I don't mean simply short circuited, or cut-out, but absolutely detached; dead wires being one of the most prolific and active agencies of disturbance and danger.

True it costs something to take down wires, and it may be troublesome to put them up again when required, but it is the only safe proceeding, and in such matters the anchor ought to be cast to windward every time. It is better to spend a few cents in defence than it is to spend possible millions on account of the misdoings of a dead wire in tribute.

Finally, if the number of disturbed wires be smaller than that of those causing the disturbance, or if it be necessary to run a telephone wire through a region of disturbance, the simplest, easiest and most economical way is not to monkey with the buzz saw, but at once to make the telephone circuit metallic; at least through the region of disturbance; which operation should moreover be invariably performed in cases where less drastic measures fail.

THOMAS D. LOCKWOOD.

MR. LOCKWOOD—Now, one word as to Mr. McCluer's device. It is true, as I said before, that the evil he has had to encounter is actual leakage from the rails, and that it has manifested itself both by affecting the call apparatus and by affecting the conversation, and there was no reason, even before he tried his device, to doubt that it would do its work. I do not know whether it has totally eliminated the noise, but if it softened it down fifty per cent., as he says; if it has made it bearable so that people can talk, a great deal has been done. There have been since the beginning of the telephone business, I think, some six hundred patents issued for different forms of telephone, and I think, perhaps, from three to four thousand patents for telephone appliances, out of which, perhaps, two hundred have directly

or indirectly referred to systems or arrangements or pieces of apparatus for reducing, eliminating or neutralizing induction. A great many are not worth the paper they are written on. But this device of a return circuit, I think, probably, was first indicated by the old way in which those of us who were telegraph men used to run what we called "combination locals." We used to have a number or combination of local battery cells, one for each sounder, and we would bring them all back over a common wire. A little later, when the telephone business began, quite a number of people, myself among others, patented a system in which a common return wire was provided for a group of circuits. That was in 1880. In the application for a patent that I put in, we had a narrow escape from an interference with some of Mr. Scribner's applications for patents, which afterwards went into use throughout Indiana, Ohio and Illinois as the Wiley-Scribner Telephone Exchange system. I know Mr. Durant remembers it, because he has been in interference with him.

MR. DURANT—The common wire was used for a call wire, was it not?

MR. LOCKWOOD—Yes.

MR. DURANT—Yes; I remember it.

MR. LOCKWOOD—Since then the very idea of using a common return as an induction neutralizer has been patented by a man named Bentley, and within the last six months the American Bell Telephone Company bought the patent with a lot of others, and the American Bell Telephone Company buys patents so that its licensees can use them. I have not made these observations with the idea of belittling Mr. McCluer's invention, because there is not the slightest doubt that he invented it independently, and for his own work; but simply to say that none of the rest of you, if you wish to use it, need hesitate for fear of trenching on his prerogatives, because it is open to every one of you who are licensees of the Bell Telephone Company.

MR. DURANT—I would say that we have for three years used that device and have it in use now. I think it is ap-

plied on twenty-four wires. It came into use from the interference of the Heisler incandescent system, which uses an alternating current. Presuming, of course, that the Heisler circuits were constructed in conformity with the rules of the Board of Public Improvements, namely, in close parallel lines, we did not examine them, and we put this common return wire in use, and we found it very effective. In the meantime we found that Mr. Heisler had one side of his circuit on one side of the street where this particular run of wires was, and the other on the other side. We made him correct that. I was surprised to hear Mr. McCluer say it was novel; but as Mr. Lockwood has already intimated, we are not afraid to use it.

THE PRESIDENT—Gentlemen, you have heard the papers read by Mr. McCluer and Mr. Lockwood. What disposition will the Association make of them? If there is no objection they will be received and filed as part of the papers of the Association. Is there any discussion upon these papers?

MR. BAILEY—I would like to move the thanks of the Association to those gentlemen for the papers which they have read.

MR. GIFFORD—I second that motion.

THE PRESIDENT—It is moved and seconded that the thanks of the Association be tendered to Mr. McCluer and Mr. Lockwood for their very able papers read before you this morning.

The motion was carried.

MR. BAILEY—I would say in relation to the troubles from electric railways, that our experience coincides in almost every particular with that of Mr. McCluer; and further, that, in so far as the gentlemen who are at the head of these railways were able, we have found them willing to do what they could when they were told how to do it. The trouble, principally, has been that enterprises of this kind are organized and foisted upon a lot of gentlemen who heretofore have not been in the business. The lines are constructed, usually by construction companies that are sent out from New York city. The gentlemen, as I

said before, who own and put their money into these companies know nothing about the requirements of their own business, but they take everything in good faith. It is the interest of the construction company to get through with the work and get their money and get out of town as soon as possible. The only course of safety for the telephone companies is eternal vigilance, during the process of construction, in raising objection to anything that they may find is deleterious to their service. Now the only railways with which I am familiar with are those having a single overhead conductor with a rail return, and with them it is necessary to preserve a uniform elevation above the center of the roadway. In doing that, it is almost impossible for them to construct the lines in such a manner as not to interfere with the telephone circuits. Their ordinary height, I believe, is regulated at sixteen feet above the center of the roadway, and it is necessary to put up poles on each side of the street about twenty feet in height, and in practice they put them up a good deal higher, in order to carry the suspension wires high enough. In the operation of the railway these trolleys running along on their conductor wire have the effect of breaking their insulation, and in the course of a little time, no matter how well they may have attempted to insulate their wires, the insulation becomes very defective, and the current leaks from the suspension wires and guy wires and everything of that kind. Therefore a line of poles set on each side of the street and charged in the manner in which they are, is very dangerous in regard to any other telephone wires, or any other wires of the kind coming into contact with them. Of course, that is only a matter of mechanical construction. I should think they might be insulated so as to prevent absolute crosses. We note the same result of leakage from the earth to our telephone wires, as we have from the grounds of an electric light circuit. You take an ordinary electric light circuit with one ground, and you find no difficulty, no damage; but the minute you get two, you get trouble. We have frequently found trouble from electric light circuits, which, when traced,

were located in electric lights being in contact with gas fixtures so badly as to throw currents into our exchanges that would throw down one hundred or two hundred drops at a flash. We complained of one of the street railways in Scranton, and at last threatened to take legal proceedings to obtain relief, and sent up to New York for some experts. Among the rest was Mr. Prescott, a very prominent electrician here, who came to Scranton and examined the system, and said it was a matter of induction entirely, and it was folly to suppose that an electric current would leak from the earth to any other conductor. After it once got to the earth it was dissipated. Of course, the opinions of those gentlemen were worth considering. At the same time the trouble continued. They went to work and improved their insulation, and have removed the trouble from a good many of our lines. In some lines they are affected still, so badly as to hold the annunciators to the coils, and of course the talking service on them is very poor. We adopted that same system, which Mr. McCluer speaks of, on some of our lines with absolute relief—that general return wire. It was not original with me; I got it from Mr. Denver, of Boston, and we found it did give us absolute relief. We have not adopted it generally, but in using that method I cannot see any objection to using a return ground and having it connected with the general ground of the exchange. But if that general ground is led off to some other point not returned parallel with the wires that are served, I do not think you get very much relief. We tried that in Scranton. We got a little relief, but very little. It is very certain that a current from those electric railways will set up currents not only in parallel telephone lines, but in lines that reach the line of their railway by a different route altogether.

THE PRESIDENT—Does the Chair understand you to say that it is not material whether the ground wire returns to the central office or whether you run it off in another direction?

MR. BAILEY—It is very necessary; but I say some lines are affected by the railway, which take a different route to reach the railway.

MR. GIFFORD—You do not believe it absolutely necessary that they should run the general current parallel with the telephone lines?

MR. BAILEY—I think the general current should return on the same line of poles as the lines that are served and as near the center of the line as possible of those lines that are served. I think you get better results than you would if you hung it below or above.

MR. GIFFORD—You said that this return of ground wires to obtain the best results, should be parallel with the lines of overhead wire and then be connected with the central office ground wire.

MR. BAILEY—We connect it to the central office ground.

MR. GIFFORD—We have twenty different routes in different portions of the city. Is it practicable to connect all those returns coming from different portions?

MR. BAILEY—Yes, so long as you do not overload your ground wire above its capacity. You can start out, as Mr. McCluer says, with a heavy wire, and as you have less wires to serve, use a lighter wire.

MR. DURANT—I think you misunderstood Mr. McCluer as to the location of the ground. He said it was immaterial whether it was in the central office or at some point remote from the center of this disturbance.

MR. BAILEY—I think it is immaterial; although the general ground should return on the same route with the wires that are served on that ground, and as nearly equidistant as you can place it from the wires that are served.

There is another point I want to call your attention to—that matter of danger of dead wires in relation to lightning trouble. We have had a little of it out in our country. Of course we have a system that covers a good deal of country, and is made up largely of country lines, and in the changes in telephone business, dead wires occur with us as they do with everyone else, and dead wires are sometimes a good deal more costly than living ones. It reminds me of the case of an old man who was a gate-keeper for one the railroads in our town. His business among other things was to

keep intoxicated persons and persons of an improper character from getting on the trains. One night a lumberman, very much intoxicated, came to the depot and the old man put him out. The lumberman was smart; he went down the track and climbed over the fence. But the old man was watching for him, and he shoved him out of the gate, and as he did so he said: "Go out; living you are not worth a cent, but dead you are worth $5,000." That is the figure in Pennsylvania which a dead man is worth.

The usual course of proceeding is, when a telephone is discontinued, to take the telephone out without making any provision for the wires; the wires are left standing. The question is, during a thunder storm, what will become of a current that may gather on that wire without any connection to the earth. It certainly has to discharge somewhere, and in discharging, it is likely to do a good deal of damage. It strikes me that it is similar to the case of a defective lightning rod which has no earth connection. We have a case of that kind, where a loop was taken out on one of our lines. The line got charged from a thunder storm and the lightning followed in on those open wires and struck a child and knocked her insensible. She recovered without any apparent damage. But it was a thing that it strikes me should be guarded against. Wires of that kind should be removed from the premises.

MR. FARNHAM—I would like to .say just a word or two on the paper of Mr. McCluer. He suggested a plan, or at least he suggested a fact, that might exist, which I thought might be misunderstood and might be misleading. He said in a large place where there were several electric light wires running that one might offset, in a certain sense, the induction from another wire, and so the difficulty need not be as serious as it would be where there was only one circuit. I have found, in several cases, in looking up these same troubles, that the electric light people have taken that ground, and have said that their system was all right, because notwithstanding the fact that each circuit was a belt circuit, yet the several belt circuits were on the same pole

with what they call the positive pole of the machine, and that consequently the interference of one line would be neutralized by the interference of an entirely separate circuit. Of course we will find, if we try it, that this is altogether false, because we cannot have two machines running at precisely the same speed and the charges of current coming together at precisely the same moment of time, and while there may be, in listening at a telephone, a moment when the noise is less, the next moment it will be very severe. One of the noisiest exchanges that we have, is where the circuits run in belts on the same poles, and yet there is no balance whatever. I speak of that, because, unless we understand it thoroughly and are ready to answer the electric light people's question in that matter, we may get ourselves into trouble. The only way to remedy that, is to take two of those circuits and make a metallic circuit; if there happen to be four or six circuits, taking the same general route, of course that can be arranged so that there will be a metallic circuit of each individual circuit, on the same poles.

In speaking of the electric railways nothing was said, I think, in the paper or in the remarks about the feed wire. Sprague's system uses a feed wire. I do not know about the Richmond system, but I do know one system in New England where this feed wire is also a bare wire. It certainly is bad enough to use a bare trolley wire with a grounded circuit, but I cannot conceive of any excuse for using a bare wire in places where telephone wires are liable to touch it at any time.

PROF. VAN DER WEYDE—I am in a position to mention certain results in regard to that general return wire, which I obtained in a series of experiments that I made some years ago with the purpose of economizing the wires with a double metallic circuit and having one general return wire. I found that if the general return wire substituted for a ground wire is not close to the direct wire it is of no use. I found that it is only reliable when the wires are all connected together as much as possible in a cable. If they are some distance one from the other, when one direct wire is nearer to an electric light

wire, or the return wire is nearer to an electric light wire than the other, we will have inductive influences. Therefore I adopted the system of making, as much as possible, a return wire—a well insulated return wire of low resistance—in the centre. I found that to be a very reliable method of obliterating the disturbing effects, not only of direct electric light currents, but also alternating currents; but it cannot be insisted upon too much that the return wire and the direct wire should be as close as possible together. We found that to be the condition. I was at that time very much pleased with the result, and was advised to take a patent for it. While it was easy enough to get a patent, I found after I had it that it was common property, that a great many had the same idea, and that patents had been given right and left for a similar idea—that of a return wire. But I cannot highly enough recommend it. It will surely give satisfaction when well applied—not at a distance, not on the other side of the street—only when closely connected, and, if possible, in a cable.

MR. SEELEY—I would like to state our experience with a common return wire for subscribers. In New York City, in 1885, we put up a Paterson cable. In those days they made a cable with a large center core; I think it was a No. 6 wire. We connected to that cable some five hundred subscribers. We grounded that central core in the central office. While that cable worked fairly well and cut down the induction and cross-talk and leakage, we discovered by ringing up a subscriber on a long wire that we would also ring up a subscriber on a short wire; and that with two wires of the same comparative resistance, if two subscribers would attempt to talk at the same time the cross-talk between those two relative wires would be very severe. We immediately abandoned the scheme and considered it useless.

I would also like to state while I am before the convention, that I presume in New York City we have a larger number of electric light wires in the air than there are in any other city in the world. All systems are represented here.

It is the policy of the Metropolitan Company to grant pole privileges to those companies. We have a blank form on which they make application to the company, and by so granting them permission to erect their wires on the property of the Metropolitan Company we are in a position to dictate to them; we tell them exactly how we desire their wires to be constructed; how many lamps on each circuit; and other details of construction. The East River Electric Light Company have about twenty-two hundred or twenty-five hundred attachments on our poles, and their wires are built in the most excellent manner. We are suffering very little from the leakage from their currents. They use the Thompson-Houston system and are giving us no trouble whatever.

MR. THORNBERRY—It seems to me, that using this return wire is providing a method almost as expensive as it would be to the Electric Light Company if they returned their wire, which in equity and justice they should do. It does not seem to me that the telephone companies should establish a precedent, which the electric light companies may force them to follow afterwards. It is only right that they should put their systems in such a condition as not to interfere with our service. If we are on the ground first we have vested rights. If we go into a district where they have built before us, they have vested rights, and we should then provide means to equalize the induction on our wires or substitute some method on theirs—that is, give them wire to lengthen out their circuits and return them in the proper manner. The return wire method, as Mr. Seeley has pointed out, has its defects, and the greatest defect it has, is that the current on one circuit will divide itself and go back on the other. Mr. Seeley tells me he has used a return wire also; but No. 4 copper and No. 6 copper is the wire ordinarily used for electric lighting, and for that length of line, if the electric light company run on one street and return on another, Mr. Farnham had better have given the electric light company the necessary wire to return their circuit on the same street,

it seems to me. I think the Convention ought to take some action in connection with the National Electric Light Association. I was almost ready to make a proposal that this Association appoint a committee who might meet a committee from the National Electric Light Association to discuss the matter of providing methods and means whereby we might harmonize the interests of the two companies.

MR. LOCKWOOD—Mr. President, no one, of course, has any doubt that any remedy proposed, which is, in itself, a half-way measure can fail to have some disadvantages. I do not think Mr. McCluer proposed to use fifty lines with only one return wire. Besides that, the return wire was not, as I understand it, proposed for electric light circuits, so much as it was for electric railways, and for instance where it is impossible to get the electric light and electric railway people to do their work properly. If there are but three or four lines or five or six lines provided with a common return, and if that common return is made large enough and of sufficiently low resistance and properly constructed, there will be no trouble with back lash. It becomes in that case more like the average hotel annunicator circuit, in which three or four lines may be connected with a single bell and a single return.

I heard Mr. Gifford ask Mr. Bailey whether it is necessary to run the return line equidistant from the group of wires which are served. Assuming that your trouble is leakage from the wires from the ground—it is not; but you must remember that when you have a return wire from a number of wires, you have got a return wire that it is possible may have a number of telephone currents circulating in it at the same time, so if you want to make the several circuits of your group neutralize one another, you must make the return wire equidistant with all of them.

MR. GIFFORD—That is an impossibility, isn't it?

MR. LOCKWOOD—Yes, sir. Mr. Bailey spoke about dead wires. I wish once more to point out, that almost the concluding paragraph of my paper emphasized that very point, that dead wires are one of the greatest sources of danger that we have to contend with, and as soon as we get an

unused wire it is our duty to take it down, unless there is an immediate prospect of a resumption of business. It is not only our duty, but it ought to be our pleasure, because it certainly does away with one source of danger and disturbance.

With reference to the suggestion offered by Mr. Thornberry, that it would be a happy thing for a committee of this Association to confer with the National Electric Light Association, I do not think any gentleman here could listen to such a proposition seriously discussed. We cannot deal with an Association in these matters. We have got to deal with individual companies and individuals themselves. An Association—even this Association—has no authority over any one of its members, though we are bound together by common interests and common ties; much less can another one with several major conflicting interests and several hundred minor conflicting interests bind its members. It would be at this time a thoroughly useless and futile thing to do.

MR. MCCLUER—If the members of the Association will allow me I would like to occupy a few moments of their time in making a little plainer, probably, than I did in my paper, one or two points that have been brought up since the discussion began. In the first place with reference to the metallic circuit and the common return wire; as a matter of course, I have known for years that the metallic circuits and the return wires have been in use. I did not suppose that I was originating anything new in devising a simple metallic circuit or a simple return wire. But I do believe that I did devise something new when I devised what I call a *compound* metallic circuit—a metallic circuit with one wire only to serve the purpose of a return wire with an unlimited number of wires attached to it. I also believe that I have devised a new idea in substituting a metallic conductor in place of the earth without any earth connection at all. I am perfectly familiar with Mr. Bentley's and Mr. Marbury's patents. They are both for anti-induction cables, and to apply these systems to telephone exchange plants would necessitate the entire recon-

struction of the plants. The system that I propose to use does not require anything of the kind—not a solitary wire on poles or house-top fixtures has to be changed or altered in any way; all that has to be done is to put up one additional wire on every route,—I do not care what the number is, one, or two, or a dozen, or hundreds of wires, on the same route,—and the only change that has to be made in the system is the simple substitution of this common return wire for the ground. To prove that, I will state that I have in the Richmond Telephone Exchange to-day, eighty-seven—to be exact—eighty-seven stations connected to a single return conductor. That conductor starts from the central office with a No. 4 covered copper wire extended to a distance of half a mile from the central office. Connected to that is half a mile of No. 6 covered copper wire, which makes the distance of a mile from the office—beyond that it is my intention to use a number 8 copper wire to reach the various stations of the subscribers. I have now one such wire only in use in Richmond, extending from my central office up Ninth street to Broad, and thence out Broad to the terminus. On that wire I have eighty-seven stations connected just exactly as they were before to the earth, and by means of this plug switch, which I have in the central office, I can use that common return wire either as a general ground wire, making all these subscribers' wires take earth at the central office, or by removing this plug I can disconnect them entirely from earth and use them as metallic circuits. Of course, I could not conceive it possible that no one had tried this arrangement before; it was so simple in itself. It was only after making the experiment I did that I induced our officers to allow me to make this practical test. When I made my first practical test, and connected my first ten or twenty stations on the first half mile of copper wire, I was exceedingly interested as to what the result would be. The very next night after it was done I went to the central office. I spent nearly two hours, from ten to twelve o'clock, with four or five of my inspectors, going to different stations that we could get into on this

line, and all of them talking over the different circuits at the same time; all of them ringing over different circuits, and doing it all simultaneously; there was no interference. You could not hear, on the call wire or on any of the wires, a word that was uttered on any of the others. I then went on, as I say, when I got the additional No. 6 wire from our Company and extended my circuit out to the western extremity of the city. I wanted a No. 8 wire to connect on to the No. 6 and No. 4 in order to reach my stations lying off on the cross lines. Our Company thought, however, that a smaller wire would answer the purpose, and they furnished me with a No. 14 copper wire. I used the No. 14 copper wire, and to-day we are using eighty-seven stations, five different taps connected up in that way, the wire being used during the business hours of the day, as a general ground wire, without any interference whatever. I have repeatedly gone to my office at night, taken this plug out of the switch and disconnected the systems from the ground entirely, got two, three, four and six people to talk at the same time on different wires on that circuit and not one could hear a word that the other said—not as much cross talk on that as on wires I have running down Carey street on the same poles. Now that is a fact. I made inquiries from some of my electrical friends that I thought might possibly have heard of the adoption of this principle before I did, but it was new to them, as it was to me, and I never had seen any intimation of anything of the kind being done in any of the public prints, although I am a subscriber to two or three technical journals. I then disclosed the plan to our executive officers and had a good deal of correspondence with them with reference to the matter before any decision was arrived at. During the progress of our correspondence I heard that Mr. Durant, of St. Louis, had tried the return ground system, and, as it was told me, without any result. I was also told that an English electrician, a telephone man, had reported that in England they had tried the same thing and had found they obtained a better result by connecting the two ends of this common return wire to the ground also, using

the earth and the wire together. Well, that was a revelation to me. I thought possibly there might be something in it. I had not thought of trying it before, but I did try it, and just the very moment that the earth was connected on the wire again, the same interference that we had before showed itself, but the very moment the earth was disconnected from the common return wire, all this interference disappeared.

I am only giving you facts, and facts that I have verified in every way that I can.

Mr. Lockwood says he did not understand me to say that it was my intention or expectation to connect any considerable number of wires to the same line. I do propose to do that. I propose to have only one wire of large conductivity on every line of poles. It does not matter whether the pole carries twenty-five wires or two hundred and fifty wires. In telegraph practice we use a single wire, and very often a No. 8 or No. 9 iron wire for a ground wire, for half a dozen or a dozen different circuits for carrying currents of greater electro-motive force, of course, than those of our telephone wires.

Here is a letter that I wrote to our General Superintendent with reference to this scheme, in which I was combating the idea of using a wire of low conductivity, and giving my reasons why it would be advisable to use a wire of large conductivity so as to provide for any possible leakage, because, as you understand, if the resistance of this common wire, which I call the artificial ground wire, is not low enough, there is going to be a leakage.

"The following table will show the resistance for ½ mile, 1 mile and 2 mile lines, as I think they should be arranged:

		OHMS.
Half mile No. 14 iron wire		23.92
Half mile No. 4 copper wire		.65
	Proportion, 36.80.	
One mile No. 14 iron wire		47.82
Half mile No. 4 copper wire		.65
Half mile No. 6 copper wire	1.04	1.69
	Proportion, 28.29.	

Two miles No. 14 iron wire	95.64
Half mile No. 4 copper wire	.65
Half mile No. 6 copper wire..	1.04
One mile No. 10 copper wire 3.04	4.73

Proportion, 20.21.

Or, if we use one mile of No. 14 instead of No. 10 we should have:

Half mile No. 4 copper wire	.65
Half mile No. 6 copper wire	1.04
One mile No. 14 copper wire	4.91
Total.....	9.60

giving 9.96 as the proportion, or a small fraction less than one-tenth of the resistance of the line wire."

Now, as I say, I am using this one single wire composed of this compound conductor, half mile No. 4, half mile No. 6 of the remaining distance; in some cases, a mile and mile and a quarter of 14 wire with eighty-seven stations connected on to that, and only taking earth at the central office, and I am working them to-day without any interference, and with a decided improvement in the character of the service. When I disconnect that wire from the ground at the central office, there is not a particle of leaking from the voice or battery, except that on some of the longer lines where we have got a mile or a mile and a quarter of No. 14 copper wire, there is a leakage from the battery current. I believe candidly that the substitution of a No. 8 copper wire in place of that No. 14 will remedy that evil.

PROF. VAN DER WEYDE--I wish only to state that, accaccording to my experiments, it is possible for twenty or thirty operators on a telephone line to communicate with one single return wire. My experiments were made five years ago in anticipation of the necessity of putting the wires underground. I found that with one return wire, I had as many as twenty or thirty different wires between which communication could be had, and that the call could be rung without mutual interference. Then I got, by the kindness of the telephone company, the use of a number of cables,

containing some hundred wires and a central wire. They call it the "Paterson cable." But the results were unfavorable, for the reason that this cable was connected at both ends with the ground.

MR. MCCLUER—To bear out the assertions I made—I was in hopes I would have met the gentleman here—I had a visit not long since from an officer of the Bell Company, a gentleman connected with the electricians' department of the American Bell Company. He spent an evening with me at Richmond, and I showed him what I had done. I sent one of my inspectors to the Northwest Pharmacy. The line was badly affected by these electric light grounds. I made him first talk to this gentleman over the artificial ground. He carried on a very satisfactory conversation in an ordinary tone of voice. While they were talking, and the gentleman was standing with his back toward me, I took this plug out, giving him the advantage of a metallic circuit, and the very moment I did that he turned around and said: "What have you done? The induction has gone entirely." Then I put the plug back, and he noticed it. I took it out, and I said: "Talk to that man in a whisper." He did so, and had a very satisfactory conversation. I told my assistant to connect the instrument with the earth. I gave the telephone back to the gentleman, and he could scarcely hear a word or make the inspector hear a word he said. Then I made the inspector put the artificial ground back again, and he talked, as before, with that return wire used as a common return ground wire, and then again as a metallic circuit. And while he did not understand, and I did not explain to him, he certainly said that I had eliminated the induction almost entirely.

MR. REILLY—I would like to say that, something over three years ago, we had occasion to run a common return wire, such as Mr. McCluer described, to overcome the induction from the Delany synchronous telegraph on a line parallel with ours for about five miles. We ran a No. 12 copper wire for about four miles, and connected to it six stations, and almost entirely overcame the noises from the telegraph

wire, and suffered no interference whatever in ringing up stations, and had no interference from cross-talk. That line is still in use and giving satisfaction.

MR. SEELEY—I beg to ask the indulgence of the Chair while I make a few remarks on the subject of dead wires. Mr. Lockwood referred in his paper to the great disadvantage and the great amount of trouble caused by dead wires hanging in the way. I would like to say that I think every city should have a subway commission, We have one, though it is very much abused; but the commissioners are removing the dead wires rapidly in New York city. They take down the poles and wires, and the companies have no trouble whatever in removing the dead wires. They do it for us.

THE PRESIDENT—If there is no further discussion on this subject we will hear the paper by Mr. Sargent, on the subject of "Underground Wires in Brooklyn."

At the request of Mr. Sargent, the Secretary read his paper, as follows:

UNDERGROUND WORK IN BROOKLYN.

The extension of underground conduits in Brooklyn has been restricted since my last observations on the subject to short sections for the purpose of connecting our new buildings in the Brooklyn and Williamsburgh districts with the underground system. All of the new conduits have been made of the creosoted wood, the ducts three inches square, inside measure, with the exception of one short section of MacDonald creosoted wood, with round holes two and one-half inches in diameter. It is fully decided, however, that hereafter no ducts will be laid with an opening of less than three inches in the clear.

In order to make ample room for the conduits reaching to our principal office, No. 16 Smith street, we have built a tunnel the whole width of the street, high enough and wide enough to walk through, and it now carries 108 ducts, with room for, perhaps, 60 or 100 more. There are special features in this tunnel and method of bringing the terminals of the cables into the building, which it is difficult to describe or reproduce in a drawing. The *Electrical Review* of August 4, 1888, gives illustrations which will convey some idea of the character of the work, and the members of the Association are cordially invited to visit the office and inspect the arrangements for themselves.

The first sections of our creosoted wooden conduits have now been in service four years. There is no evidence of decay and the ducts remain clean and dry, enabling us to draw in and withdraw the cables without any difficulty.

So far as conduits are concerned, we think experience has fully sustained our judgment in favor of the creosoted wood.

One of the most important things, after the conduits, in underground work,

is the manholes, which should be as large and commodious as possible. Within reasonable limits it is almost impossible to get these manholes or working chambers too large. While we from the start realized the importance of this part of the work, we have in quite a number of instances been compelled to rebuild and enlarge the manholes, as first designed. Given a conduit of durable material, connecting with commodious manholes, this part of the underground problem, so far, presents no serious difficulty.

The character of the cables to be drawn into the ducts and the method of distributing wires from them are questions that demand our most earnest attention.

Experience has taught us that larger conductors and thicker insulation, together with twisted metallic circuits, are an essential part of perfect service. Conductors of .035 to .040 of an inch in diamater, insulated to .125 of an inch in diameter and twisted in pairs, with 100 to 104 wires, or 51 or 52 metallic circuits, make up a cable of from two to two and one-quarter inches in diameter. Such a cable will weigh between four and four and one half pounds per foot, according to the amount of lead; and on account of the tendency of the lead pipe to buckle in bending, we do not believe that it is practicable to handle cables of larger diameter and weight. The consideration of these facts led us to decide that our ducts should hereafter be three inches.

We are using nothing but the lead covered type of cable, some of which has been in service underground for four years and is still in good condition. Of the cables which were laid four years ago, those covered with pure lead appear to be more than half eaten through. One that has been drawn out during the writing of this article has been underground for two years, and is badly corroded, there being holes eaten in it in many places nearly one-sixteenth of an inch in depth. Of the cables furnished by the Western Electric Company at the same time, in which there is a small percentage of tin mixed with the lead, the corrosion is very slight, and we are led to believe that cables covered with this alloy will last from three to four times as long as those covered with pure lead. We believe that if in addition to the tin the cables were drawn through a bath of gas tar or asphaltum, then covered with a good stout braid and run through the gas tar or asphaltum again, the cables would be practicably imperishable, so far as the outside covering is concerned, and it is a question whether this additional expense would not be justified by their increased length of life. It is certainly worth the trial.

The air-tight terminals which were put on all our lead cables more than a year ago appear to have removed all the difficulties which we formerly had at that point, and the tests of our cables, making due allowance for temperature, etc., show that there is no deterioration during the past year.

Of the cables mentioned by me last year, one of 7,180 feet, containing 100 wires, twisted indiscriminately, manufactured by the Western Electric Company, has been reduced by the change to the new central office to 6,344 feet. Tests made August 16, 1888, give the insulation 800 megohms, capacity .22 microfarads, resistance of the conductors, 43½ ohms per mile. The conductors are .038 of an inch in diameter, insulated to .088 of an inch. For a time during the past year all the conductors were in service, but recently the trunk lines to Bed-

ford office have been taken out, and there are now 80 wires working through it. The condition of this cable in regard to cross-talk is the same as last year. That is, it is not bad enough to prevent its use.

The cable manufactured by the New York and New Jersey Telephone Company, with 100 wires, twisted in pairs, has been reduced to 6,117 feet. Tests August 19, 1888, give the insulation 89 megohms per mile, capacity .275 microfarads, and resistance of the conductors 48 ohms per mile—temperature in both these cases being, in the air, 80 degrees, and of the water from the hydrants, 73 degrees. We assume that the temperature of the water from the hydrants is the temperature of the air in the conduits. 74 wires are working through this cable, and the cross-talk is no worse than last year, and is not so bad as to prevent its constant use. In both cases all the dead wires are kept grounded at the cable terminals.

The greatest length of cable we now have underground is 11,800 feet, between our Bedford and Williamsburgh offices, consisting of 100 wires, twisted in pairs, the pairs broken up at all the splices, conductors, .035, insulated to .075. The insulation of this cable is 99 megohms per mile, capacity .26 microfarads, resistance of the conductors 47 ohms per mile. Seventeen conductors in this cable are in use for trunk service between the two offices, the rest of the wires being grounded close to the terminals at both ends. The cross-talk in this cable is very slight, and is indeed less than in the Western Electric cable of 7,000 feet. We received complaints from both these offices that the talking by subscribers through this cable was difficult and unsatisfactory. A special investigation of these complaints at the points they originated demonstrates that the difficulties complained of are not in the cable but rather in the condition of the transmitters and instruments in the various offices and carelessness of the subscriber. Considering this cable as a whole, two miles in length, its electrical qualities are, insulation 50 megohms, capacity .52 microfarads, resistance of conductors 94 ohms. We are inclined to think this is about the limit of good working in that type of cable, and that the complaints we are getting about the service over it are due to the fact that it loads up the circuit so that there is no margin for any deficiency in the subscribers' circuits connected to it; whereas, if its efficiency was higher there would be a margin to cover such defects and complaints would be prevented. There is no doubt that the reduction of the cross-talk and the increase in the capacity is due to the fact that 83 of the 100 wires are grounded at the terminals, and that when the whole cable is put into service this condition of affairs will be changed more or less; that is, the capacity will diminish and the cross-talk will increase.

It was a consideration of the difficulties to be encountered in the use of greater lengths of this type of cable, which the above experience emphasizes, that decided us during the past year to make a special cable for our trunk lines, doubling the weight of copper and thickness of insulation. This resulted in our ordering three miles of cable, conductors .052 of an inch in diameter, insulated to .125 of an inch, 60 wires laid up indiscriminately, and during the past two months two miles of this cable, or 10,560 feet have been put up on the elevated railroad structure, connecting the Brooklyn central office with the Bedford central office. The insulation is between 1,200 and 1,500 megohms

per mile, capacity .27 microfarads, resistance of conductors between 21 and 22 ohms per mile, at a temperature of 74 degrees. This cable, although of the same length as the one between the Bedford and Williamsburgh offices, just mentioned, gives surprisingly better results, the cross-talk being very slight and the volume of sound full and strong. Forty of these wires are grounded at the cable terminals and 20 are in active service.

There does not seem to be anything in the electrical measurements to indicate what causes the difference in the practical working of the two cables, but the results are gratifying, and seem to plainly indicate that increasing the weight of the copper and thickness of the insulation is a step in the right direction, and I am inclined to think that grounded trunk wires of this last type may work successfully between our various Brooklyn offices, the distances between which do not exceed two and one-half miles.

All the new cables we have used this year have been of 102 wires, or 51 pairs, twisted, laid up in regular cable form, in alternate reverse directions, conductors .035 of an inch in diameter and insulated to .125 of an inch. The insulation of these cables, when placed in position underground, ranges from 1,500 to 2,000 megohms, capacity from .17 to .18 microfarads, and the resistance 52 ohms per mile. We believe that this type of cable will fulfill all the conditions required in our underground work, but at the present time we have no length sufficient to give actual working results.

The transition period between grounded and metallic circuit systems will be very troublesome and annoying, and may last for several years. It is our intention in ordering the type of cable just described to make provision in the manholes for joining the sections together by devices, which will enable the joints to be opened readily without cutting the cable and the pairs broken up in order to prevent cross-talk on grounded circuits; and, at the same time, allow of access to them for straightening them through when twisted metallic circuits are required. The necessity for getting at the joints in this way from time to time, and the space required to accommodate connecting boxes, is another argument in favor of large and commodious manholes.

The durability of lead pipe, with a slight admixture of tin, the maintenance of a uniform and high insulation, together with uniform resistance of conductors, after four years of service, are indications of length of life that are very encouraging.

Up to the present time we have met with no serious accident in our underground work, either from explosions of gas or the men being overcome with foul air. We believe it quite likely that gas is not as plentiful in the streets of Brooklyn as it is in many other cities, and therefore the accumulation in the ducts and manholes is not so great; but we have been very careful not to spare any precautions that would insure our safety.

The Dorsett conduit, of which we have five miles, with ducts two inches in diameter, has proved to be very unsatisfactory, and the ducts, on account of inequalities at the joints, will only permit of a cable an inch and a quarter in diameter being drawn in. This reduces the capacity enormously, and is, therefore, a source of inconvenience to us.

It is plainly proved that the use of underground wires reduces the margin

of good working very largely, and will therefore require that extraordinary care must be taken to bring the service to its highest efficiency at all other points.

The most fruitful source of trouble is the transmitter and battery, and while there have been very great improvements during the past year or two, there is still room for much more improvement before we reach perfection. The numerous contacts, in the magneto bells and other apparatus, need especial attention and care, and platinum should be used wherever possible.

Another source of trouble is carelessness in running the wire from the insulator outside the building to the instruments in the building. The writer knows of many cases where the subscriber's wire is run through the window casing with the ordinary cotton-covered wire, and but little care taken in the inside of the building to keep it away from possible dampness.

As the mileage of underground wire increases, these and other faults, now overlooked, will become more and more apparent and the expense of maintenance and inspection will be largely increased. There is only one way to bring back the easy working margin we have enjoyed on pole wires, and that is by the use of metallic circuits, and the sooner we get down to that basis the better it will be for the service.

The following shows the actual extent of our underground work on September 1st, 1888:

	MILES.
Length of conduit	15.17
" duct	105.3
" cable	22.93
" conductor	2,053.3

1,913 subscribers are working through underground wires, using 1,229.9 miles of wire.

W. D. SARGENT.

THE PRESIDENT—I understand from the Secretary that Mr. L. F. Beckwith, of the Metropolitan Telephone Company, has a paper supplemental to this. Is he present, and will he read it?

MR. BECKWITH then read the following paper:

THE NEW YORK SUBWAYS.

Mr. President and Gentlemen—In the following statement I have recorded a few data relating to the construction of electrical subways in the city of New York, which may be of interest.

The work was commenced in the latter part of 1886, and has been carried on since with but slight interruption each year during the season favorable to out-of-door operations.

The subways as laid out and built have been authorized and approved from time to time by the Board of Electrical Control, and the Consolidated Telegraph and Electrical Subway Company has been directed by the Board to

construct them under its contract with the latter. The execution of the work has been entrusted by the above company to its sub-contractor, the Phœnix Construction Company, which has charge of all subway construction in this city.

The subways have been designed and laid out to meet the main requirements of the chief connecting or trunk lines of the various electrical companies so far as they could be ascertained, and so far as they could be conveniently grouped together. The principle of keeping the high tension electric currents for arc lighting and power in subways on one side of each street, and the low tension electric currents for telephone, telegraph, and other purposes in subways on the opposite side of the street, has been laid down and so far adhered to. The question of distribution from the conduits has been wisely left by the Board of Electrical Control to the various electrical companies to express their preference for the method best suited to their special systems. This the companies have been repeatedly invited to do, and while some have responded, and their methods of distribution having been approved as reasonable and feasible, they have been accommodated as rapidly as possible; other companies have held aloof and refrained from action, apparently wasting precious time and neglecting to occupy and secure their commercial field and districts.

The subways built, except the Edison, are all on the "drawing in" system, which provides a group of tubes or ducts extending from one manhole to another, admitting of the drawing in and out of the electrical cables, and affording convenient access from the street.

Different systems of grouping the ducts in the trench, and different materials have been employed, consideration being held of the importance of the line; the question of cost, the durability, tightness against water and gas, etc. Experience has shown us that the main conduit consisting of separate pipes which can be crowded or curved, or kept apart, is the best adapted to overcome the numerous obstructions met with under ground, and frequently diminishes the trenching necessary. Screw-jointed, asphalted, wrought iron pipe laid preferably in hydraulic cement concrete present the greatest tightness of duct against gas and water united with the greatest strength. The cement pipe and creosoted wood tubes present also features of great merit and adaptability. A special feature of New York subway difficulties is the steam heating underground system, of which the leaks in certain localities greatly interfere with the ducts and cables, precluding the use in such places of materials of construction softening or melting at about 160 to 200°F. In the case of long telephone lines, the desirability of comparing non-metallic and metallic ducts in respect to their influence on low tension currents has also been kept in view. A continuous line of telephone and telegraph subway is now completed about seven miles long, and the above comparison can be made on five to six miles of this length.

The endeavor has been to provide a subway construction that will be most durable and that will give the best mechanical protection to the cables against injury from settlement of the ground, heat, water, gases, etc., etc. The solution of the electrical question of underground working is one that relates to the manufacture of suitably insulated cables, and belongs properly within the province of the electrical companies.

The work accomplished up to September 1, 1888, is shown in the accompanying tables:

	Feet.
Dorset ducts, coal tar concrete	235,837
Zinc tubes, laid in hydraulic cement concrete	68,883
Creosoted wood tubes	167,175
Cement pipe, laid in hydraulic cement concrete	216,626
Iron pipe, laid in asphaltic concrete	131,284
Iron pipe, laid in hydraulic cement concrete	1,423,722
Iron distributing pipe	23,301
Edison iron tubes	222,794
Grand total length of single duct	2,489,602

Grand total length of single duct	472 miles.
Grand total length of trench	37 "
Number of manholes	523
Total length of telephone and telegraph ducts	376 miles.
Total length of electric light ducts	96 "
Length of telephone and telegraph trenches	19½ "
Length of special electric light trenches	17½ "

Besides the above there is still about ¾ of a million feet of single duct for telephone, telegraph and electric light purposes, authorized by the Board of Electrical Control to be built, that remains to be constructed, besides contemplated lines.

The standard size adopted for telephone ducts is 2½ inches clear inside diameter, corresponding to a capacity of 100 wires or 50 conductors in metallic circuit grouped in a lead-covered cable. The chief portion of electric light ducts other than Edison ducts are 3 inches clear inside diameter.

The manholes are all of brick, laid in cement mortar, with 8 to 12 inch walls and concrete bottoms. They vary greatly in form, and are from 8 feet by 12 feet to 4 feet by 4 feet 6 inches in size, and from 6 to 12 feet deep. The street casting used has a double cover; the inner cover and rubber gasket are held down by a wrought iron cross-bar, a bolt and padlock. The covers are practically tight against water.

The systems of distribution in use are as follows:

For telegraph purposes, an iron pipe from a manhole connects underground with a building or with the foot of a pole.

For telephone purposes the above method is used, and also in connection therewith a pipe running up the face of a building to the roof, where from a fixture the cable is divided for distribution on the block and surrounding blocks. Sometimes the pipe is carried up through an elevator or ventilating shaft. In addition to the above, in the down town district and along Broadway to Union square, an iron 3 inch pipe is laid in the trench above the subway, and provided at intervals of about 50 feet with malleable iron circular distributing or service boxes, with screw covers 12 inches in diameter, with side outlets through which a cable can be conducted by a service pipe into the buildings.

For electric light distribution the Edison Company have their special system laid. The "Johnston" cast iron distributing conduits, with 6 ducts and flush boxes, has been authorized to be laid in Broadway, from 14th street to 35th street, for purposes of electric light distribution, and will provide all the necessary facilities for this district.

Up to August 27, 1888, there were 3,567 miles of wire laid in the subways by the Metropolitan Telephone and Telegraph Company. This company has laid a 100 wire lead-covered "Paterson" cable, from Whitehall street to 58th street, a distance of about six miles; this cable is believed to be the largest of this size in existence underground. The Western Union Company have about 100 miles of wire underground, and the Edison Company about 126 miles. The Brush Electric Illuminating Company are putting an 8 conductor "Standard" cable in the Broadway conduit, from 14th street to 35th street, a distance of one mile, making 8 miles of electric arc light wire.

Other applications for space in the subways and for the construction of additional electrical light lines are pending.

LEONARD F. BECKWITH, C. E.

MR. BECKWITH—I might say, Mr. President, that considering the difficulty of giving any technical details with regard to the work, if any member who is interested in looking up and examining the work, or in seeing the plans or going into a more extended examination of how subways are built in New York, will call at 18 Cortlandt street, I should be very happy to give all information I have at hand that lies in my power.

THE PRESIDENT—The Association has heard the very valuable and interesting papers read by Mr. Sargent and Mr. Beckwith, and if there is no objection, we will return the thanks of the Association to those gentlemen for their papers.

The Association, Mr. Beckwith, returns thanks to you for your very valuable and interesting paper.

Mr. Sargent, you will consider yourself thanked also.

The next paper to be read is entitled "Telephone Exchanges of New York City," by Mr. E. F. Sherwood, of the Metropolitan Telephone and Telegraph Company.

Mr. Sherwood read the following paper:

THE TELEPHONE EXCHANGES OF NEW YORK CITY.

The Metropolitan Telephone and Telegraph Company has 7,300 subscribers, operated by eleven exchanges, which are furnished with the following systems: John, 39th and Harlem Exchanges, Western Electric Multiple; Pearl, New, Nassau, Murray and Twenty-first Street Exchanges, use the Chinnock system; Spring Street, the improved Chinnock system, adapted by Mr. Jos. P. Davis, formerly general manager of the Company; Fulton and Beaver Street Exchanges use the Law system.

John Street Exchange has 799 subscribers and 40 trunks distributed among them. Thirty-ninth Street Exchange has 1,108 subscribers, 39 trunks. and Harlem has 374 subscribers, but no trunks terminating outside of the trunk sections. The reason that we have trunks at the two former exchanges among the subscribers, is to connect the system with points not accessible or convenient to reach with trunk calling wires.

To operate the boards during the busiest hours requires the following number of operators: John street, 14 operators, 57 subscribers per operator; Thirty-ninth street, 21 operators, 52 subscribers per operator; Harlem, 6 operators, 62 subscribers per operator, but counting the trunk wires according to the business done over the average subscribers' wire will be equal to adding 73 subscribers to John street, and 70 to Thirty-ninth street, thus increasing the average at John street to 62, and at Thirty-ninth street to 56. The reason we have a greater average at John street and Harlem is that they are situated in the centre of business districts, while Thirty-ninth street, being a manufacturing and residence district, a larger portion of the business is trunk.

We are using what we term trunk calling wires between the various exchanges, one terminating at John street and the other at Thirty-ninth street, for calling all trunk connections to the exchanges named.

There is an average of 3,000 connections per day called over each of these wires, and as each connection is ordered off again, the number of orders is increased to 6,000. All of this work is done by two operators at each of these exchanges, and could be done by one if a whole section of the board was within her reach. We divide the trunks, one-half being used for receiving and the other half for sending. Those we receive on are not multiple through the board, but end in cords and stand open at all times except when in use. When a number is called on any given trunk, the connection is immediately made and is ready for ringing, this being done by the office calling, as we make the office where the call originates responsible for the connection. If the number called is busy, we throw battery on the trunk, dropping the annunciator as a signal. We find this system very advantageous, as there is no delay in calling or clearing trunk connections, and the service is made prompt as shown by ten trunk connections made and conversations started with subscribers in six and one half minutes.

At the exchanges which have the Chinnock system each operator at the cases answers 100 subscribers and completes all local connections. using a local calling wire and a set of local trunks which connect all the cases together. The calls for trunk connections are written on slips of paper and passed to the operators who control the trunks to various exchanges. Ten trunk connections were made and conversations started through this system in twelve and one-half minutes.

The Fulton and Beaver Street Exchanges have, together, 410 subscribers and are operated by nine operators and one chief operator. All local connections are completed by the operator who receives the call over the calling wire, and trunk connections are completed by the operator at the exchange for which the subscriber calls. The Law operator simply connects the subscriber's wire with the trunk wire and rings down the annunciator, when the operator answers and ascertains from the subscriber the number wanted. Ten trunk connections made through the Law system were completed and conversations started in four and one-quarter minutes. Ten local connections in two and three-quarter minutes.

The number of trunk wires connecting the exchanges in New York city is 532, and average 60 connections per day, and as this average could be increased to 70 per day, the number of subscribers could be increased 600 without increasing the trunk facilities. To other exchanges we have 187 trunks, and with those the service is quite satisfactory, and especially so with the new Brooklyn exchange of the New York and New Jersey Telephone Company, as the service is prompt and satisfactory in every particular.

By the consolidation of the seven exchanges in the new exchange at No. 18 Cortlandt street, 206 trunks which connect these exchanges will be abolished, and the number of trunks to all other exchanges may be reduced for the total number divided among the seven exchanges will not be required when they are all accessible to an operator in the new exchange.

The new switchboard at No. 18 Cortlandt street will soon be completed and the consolidation of the seven exchanges made. It is wired for 5,100 subscribers and 900 trunk wires. The subscribers' operators will attend to 50 or 75 wires according to the business done at different sections of the board. Trunk calling circuits to the other exchanges will be in operation, each receiving trunk operator attending to 50 wires. The local battery of each operator's outfit will be two cells of storage battery, one to be in use during the day and the other at night. The one in use during the day will be charged at night from the main storage battery and the night battery will be charged from a dynamo during the day. All wires will approach the exchange through the underground system, the underground cables terminating in the cellar. From there they will be carried to the distributing board in the exchange by 334 conductor cables.

The consolidation of the several exchanges will be beneficial in many respects. The service will be improved, the great volume of "sent" trunk business will be reduced from 200,000 to 8,000 connections, and the running expenses of the exchange will be reduced about $2,700 per month.

One thousand five hundred and twenty-seven miles of wire are now underground and 2,784 separate wires are altogether or in part so working, most of which give general satisfaction. The underground facilities are rapidly increasing. 18 miles of 102 conductor cable running from 18 Cortlandt street to various points are now completed and will be used when the exchanges are consolidated. Eight and three-quarter miles of the same cable will soon be run for trunks from 18 Cortlandt street to the other exchanges, thereby making the trunk service from this exchange entirely underground and doing away with the delays and expenses of crossed and broken trunks, and will do away with

the danger of crosses with wires carrying a heavy current, which proved so costly in connection with the burning of the Thirty-ninth Street Exchange, on which a few remarks may be of interest.

On May 23d the Thirty-ninth Street Exchange was set on fire by a cross with a wire carrying a heavy current, and one and one half sections of the board was burned out. The work of restoring the Western Electric Multiple Board after it has been burned and saturated with water can only be appreciated by those who have had it to do. In order to straighten out the wires it was necessary to make 1,260,000 tests, to splice 9,600 broken wires, to replace 16 cables which were destroyed from the switchboard to the cupola and dry out the saturated portion of the board. The work of getting the lines in complete working order was delayed by the accumulation of line trouble while the troublemen were working in the exchange, but the switchboard and all the lines were in complete order two weeks from the date of the fire.

E. F. SHERWOOD.

Mr. W. D. Sargent, Vice-President, here took the chair.

THE CHAIR—Gentlemen, you have heard the report of Mr. Sherwood; what action will you take?

A MEMBER—I move that the thanks of the Association be tendered in the ordinary form.

THE CHAIR—It is moved that the thanks of the Association be tendered to Mr. Sherwood for his very valuable paper, and that it be printed in the proceedings of the Association.

The motion was carried.

THE CHAIR—There is another paper to be read, by Dr. Plush, of Philadelphia, on "The Telephone." I think it would be, perhaps, as well to read all the papers and then take up the discussion of them, one after another, in the remaining time that we may have before adjournment. If Dr. Plush is here, I will ask him to read his paper.

MR. DURANT—While you are waiting for Dr. Plush—I know you are all deeply interested in the Law system—I want to speak of the system we have in use between St. Louis and East St. Louis, which I think is novel. If you are familiar with the Law system, as I presume you are, you know that we use two kinds of call wire, the one metallic and the other an open circuit. East St. Louis, while it is in the State of Illinois, and on the opposite side of the river, has a relation to St. Louis, commercially, that is very important. The railroads all terminate there, and the business between St. Louis and East St. Louis, telephonic and other-

wise, is very great. The exchange at East St. Louis consists of only fifty subscribers, and about ninety per cent. of the traffic of that exchange is with St. Louis. Ordinarily, in the Law system, the trunk line business is done over two receiving wires, one from exchange A to exchange B, and the other from exchange B to exchange A, and we have that same arrangement between St. Louis and East St. Louis. However, the ordinary method is for the first operator to throw a telephone and transmitter into the sending call wire and give an order, expressed by numbers, to the second operator. In the case of East St. Louis, which is occupied by an open circuit call wire which runs to the operator at the central office at East St. Louis, that line is extended —it is not grounded at East St. Louis—but it is extended to the receiving operator at St. Louis. Consequently the order for traffic at East St. Louis is heard by both operators—by the one at East St. Louis and also by the one at St. Louis. The direction of the traffic is indicated by numbers. The numbering series at St. Louis commences at 100, and runs up to 5,000, while the numbering at East St. Louis is confined to the 5,000 series. When the subscriber at East St. Louis gives his order, of course the direction of the connection is expressed in the way given. That order is overheard by the operator at St. Louis, and without any word between them they select the lowest number idle trunk line, and the connection is made without any word passing between them. If any of you can beat that on the trunk line service, we would like to know it.

MR. SEELEY—I would like to state, Mr. Chairman, that we are using a call wire precisely as Mr. Durant describes. The operator who could formerly handle only seven trunk wires is at the present time handling fifty trunk wires. She virtually acts as a switchman at No. 1 exchange, while the operators at No. 2 exchange are simply calling into her from the call wire. I presume the company is saving ten or twelve thousand dollars a year in salaries on the trunk line system alone.

MR. GIFFORD—There was something said this morning in

regard to this return wire. I think the experiments practiced by Mr. McCluer were with the Law system of exchange, were they not?

MR. MCCLUER—They were, sir.

MR. GIFFORD—What I wish to inquire, to bring it down to the practical application, is, whether any one here has attempted to use this return ground wire—universal ground—in connection with the magneto system?

MR. MCCLUER—There is no difference.

MR. DURANT—Mr. Seeley explained that this morning. He said they had tried it and that the short and long wires interfered with each other.

MR. GIFFORD—I did not catch that. I have been considering that thing. I am very glad the experiment has been tried and that somebody else has been to the expense before me. I did not understand fully that it worked as satisfactorily with the magneto system as with the Law system. One is a magneto and the other a battery current.

MR. MCCLUER—It doesn't make a particle more difference than it does between the earth and any system. You use the earth for any system and you use this artificial earth in precisely the same way.

MR. GIFFORD—There is another difference: in the magnetic system the lines are grounded in your central office; I do not know but what that would make some difference.

MR. MCCLUER—Not a particle.

THE CHAIR—Is there any further discussion on the switchboard question?

MR. DURANT—What switchboard are we discussing?

THE CHAIR—I meant on the general principles of switchboards. We have three or four papers; the one that Mr. Sherwood read was in the direction of switchboards, and Mr. Seeley's remarks also, and we have had before us the underground work in Brooklyn; and Mr. Beckwith's paper on the underground question. It seems to me that it would be well to apply the discussion to these subjects one after another, and therefore I will call for any remarks on my own paper on the underground work in Brooklyn, and Mr. Beck-

with's paper on the underground work in New York. If there are any remarks by any of the gentlemen on those subjects, I think now is the time to make them. Furthermore, I hope the members will remain here, as in a very short time we will take up the question of where we shall meet next year. Members should wait to decide that important question, even if they do not take any interest in the subjects under discussion.

MR. DURANT—I thought that was generally left to the Executive Committee.

THE CHAIR—As to the date only, I believe, Mr. Durant. The Association usually decides the place; but on account of circumstances, local to the place selected, the time is fixed by the Executive Committee.

If there is no discussion on these papers I will ask the Secretary to read the paper by Dr. Plush.

The Secretary read the following paper by Dr. Plush:

THE TELEPHONE.

Mr. President—No discovery or invention was ever born at a time when the world was more ready to receive it than that of the telephone; notwithstanding which, great talent, perseverance and wealth were necessary to its successful introduction. The uncertainty which unfortunately hedged it about gave rise to temporary work and machinery, which has simply been renewed to the present time, and to-day the vast telephone system of the country is but a network of unreliability and temporary make-shift. Even the head centers of main exchanges (with but few exceptions), representing untold labor and the expenditure of large sums of money in machinery and apparatus, are held by but a feeble tenure.

At that period but little time was given for consideration, and a forecast of what the future would be, was difficult. The growth of the telephone plants was without a parallel in any industry; the demands made upon them were greater than their means of supply; competent labor was not in the market, and efficient machinery had not been devised.

The difficulty of meeting the requirements of a large number of subscribers at a given point early presented itself, and gave rise to a number of small exchanges, even in the most populous districts. This, together with the resistance on the part of public authorities to the erection of necessary conductors, set the seal of fixidity upon what is manifestly a great hindrance to good and reliable service, while in no wise conducing to economy. The expense for rents, light, fuel, trunk-lines and the introduction of so many additional connections into circuits call loudly for aggregation, and we believe the tendency is in this direction, and the time not remote when trunk lines will be known only as a means of reaching points far distant.

Probably the greatest drawback to-day to the complete development of our telephone systems is a growing tendency in legislative bodies to regulate prices to be charged for service, which in effect is simply to paralyze its growth and efficiency.

Were the telephone the only means of communication some regulation might be wise ; such, however, is not the case. We have the postal, telegraph and messenger service, each filling its own peculiar sphere as regards reliability, speed and cheapness.

The telephone should, as far as practicable, combine all of these features, but neither should be sacrificed to the others , to regulate either must be at the expense of the whole.

When the field is once open to competition, that company which rigidly adheres to reliability and promptness in its service will not suffer through paucity of its finances.

Nothing, in my opinion, has operated more to the disadvantage of both the telephone companies and their subscribers than cheap rates. Many, through this means, have been induced to become subscribers to an exchange who have no real need for the facilities it affords. This lends a tone to their business, it is true, and serves in a measure as a card of respectability. Their place at once assumes an imaginary importance, and if there is any one thing that delights them more than another, it is having some real or fancied business with a leading and substantial firm. This they manage to have at frequent intervals, thus taking the time and monopolizing the wires of others, to their detriment and absolute loss. Important business is thus delayed, and the value of the exchange materially lessened.

Busy houses, to-day, find it necessary to have some one in constant attendance at the telephone, and yet many calls are so delayed as to be useless. It is but fair, therefore, that their interests should have as many safeguards thrown around them as possible ; that their conveniences and time may not be engrossed by frivolous questions, in which they have no interest whatever.

In other words, an exchange may be so large as to be comparatively worthless.

Constant effort toward speed, both of connection and disconnection, is being made, thus making a greater number of calls in a given time possible, and thereby removing the limit, which would otherwise soon be reached ; but, this limit must ultimately be reached, and what then ? Even now requests for discrimination in making connection are not uncommon.

At the present growth of our larger exchanges the time must come when a more select means of communication will be demanded by the business public. That is an exchange for business (select, if we may so term it) where a party to become a subscriber will not only be required to pay his annual rental for service, but must hold a certificate of membership as well.

George Eliot remarks that we begin life, knowing little and believing much; a few years of experience, however, and in many cases, the quantities are inverted. This aptly applies to every man connected with electrical science and mechanics, particularly the telephone and its environments.

We live to-day in the same atmosphere we did ten years ago ; nothing has

materially changed, except ourselves, and we only in credulity. True, our experience has been great and varied, and has taught us in some instances how not to do, and by this slow but certain method of evolution may in time teach us how to do.

It is difficult for us to realize that we are gradually making a history, and that the records of the great telephone must eventually be written; that we are each of us contributing thereto; that no matter how small a factor each may be, he is a part, and that at last his individual size must be determined by the magnitude of the whole.

It behooves us, therefore, to see that the foundations of the telephone—which are now being laid—shall be solid and firm; that every right, every franchise shall be permanent; every structure substantial, every centering point immovable and every method correct, and to this end the energies and intelligence of those associated with the telephone can be profitably directed.

S. M. PLUSH.

THE CHAIR—Gentlemen, you have just heard the paper contributed by Mr. Plush. What is your pleasure?

MR. SEELEY—I move you that the paper be spread upon the minutes of the Association, and a vote of thanks be extended to Dr. Plush.

The motion was carried.

THE PRESIDENT—Are there any remarks on this paper?

MR. DURANT—Since you ask for remarks, Mr. Chairman, I will make this remark, that I do not believe there is a class of men in the world who appreciate the telephone less than the men engaged in the business. The reading of the paper called to mind a statement made to me by the manager of one of the largest and best papers in the country, published at St. Louis. He told me that on the night of the earthquake, it occurred about twelve or one o'clock at night, that inside of two hours he called up one hundred and three stations in various parts of the city and got two columns of very interesting matter, showing the effect of the shock in various parts of the city. That will, perhaps, show its value in one direction.

The capacity of an operator under great stress was decided in our exchange, I think, last January, under the direction of Mr. Doolittle, and if any of you have not made that test I would suggest to you to make it, to show the number of connections that can be made in a given time by a single operator. On this test fifty-three were made in five minutes.

A MEMBER—How many do you suppose that operator could make in an hour?

MR. DURANT—I don't know; I suppose seven or eight hundred.

THE CHAIR—Are there any further remarks on the subject of the telephone? If not, we will take up some other matter. The application of the National Conduit Manufacturing Company for associate membership in this Association has been approved by the Executive Committee and now comes before the Association for their action. What is your pleasure, gentlemen, in regard to this application for associate membership?

MR. EASTABROOK—I move that the action of the Executive Committee be approved, and that the applicant be elected as an associate member.

The motion was seconded and carried.

THE CHAIR—The next question before the meeting will be the place of meeting for next year. The Secretary will read two letters which have been received.

The Secretary read the following letters:

"NEW YORK, Sept. 4, 1888.

"HENRY METZGER, ESQ., *President.*

"*Dear Sir,*—In behalf of the Erie Telephone and Telegraph Company and the Northwestern Telephone Exchange Company, I take pleasure in renewing our invitation of last year that the next session of the National Telephone Exchange Association shall be held at Minneapolis, Minn. With assurances that there shall be nothing lacking for the comfort and enjoyment of the delegates, I trust that this invitation will be unanimously accepted.

"Fraternally yours,

"CHARLES J. GLIDDEN,

"*Treasurer.*"

"September 4, 1888.

"THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

"C. H. BARNEY, ESQ., *Secretary.*

"*Dear Sir,*—On behalf of the Michigan Telephone Company a cordial invitation is extended to the Association to hold its next annual meeting at Detroit, Michigan.

"Very truly yours,

"F. A. FORBES,

"*General Superintendent.*"

MR. DURANT—I move that Detroit be fixed as the place of the next annual meeting.

The motion was seconded.

MR. METZGER—I move that Minneapolis be selected as the place of the next annual meeting. I think it is certainly due to the Erie Company, after the manly effort they made last year, to secure Minneapolis as the place for our next meeting, that this Association should meet their views and their request. If we go to Minneapolis, we certainly, most of us, will pass through Detroit, so that we will see Detroit, and if we go to Detroit only, we will not be very apt to see Minneapolis.

MR. GIFFORD—I believe that when this matter was discussed last year it was tacitly understood that if Minneapolis waived her claims for this year, that we would meet at Minneapolis next year, and I think it is due to Minneapolis, as our worthy President says, that we should go there for our next meeting. After that, I would like to go to Detroit, if they would invite us.

MR. BAILEY—In view of the very pressing invitation received from the gentleman from Minneapolis last year, I think it would be exceedingly discourteous not to accept this pressing invitation.

THE CHAIR—Are there any other suggestions, gentlemen, as to the place of meeting? If not, I presume we shall have to take a ballot.

MR. EASTABROOK—In order to save a ballot, unless Mr. Metzger is willing to make his proposition in that shape, I move Mr. Metzger's resolution as a substitute for Mr. Durant's. Probably Mr. Metzger will accept that.

MR. METZGER—I will accept that suggestion and offer it as a substitute.

THE CHAIR—It is moved and seconded, that Minneapolis be substituted for Detroit in Mr. Durant's resolution. All in favor of the substitution of Minneapolis for Detroit will say aye.

The motion was carried.

THE CHAIR—That brings the question back to the

original resolution, which is, to designate Minneapolis as the place of meeting for next year.

The motion that Minneapolis be selected as the place of meeting next year was then put to vote and carried.

THE CHAIR—I believe that, fairly, finally and fully decides that Minneapolis shall be our place of meeting next year.

MR. GLIDDEN—I desire to thank the Convention for the acceptance of this invitation, and I will guarantee Mr. Durant a nice time if he will come to Minneapolis.

MR. DURANT—I have not the slightest doubt of it. I did not want to see Detroit slaughtered, though.

THE CHAIR—There is one other paper here to be read. It is entitled "An interesting judicial opinion as to the rights of a telephone company against house-movers." I do not know whether that is a very interesting subject to the members here present. The paper is not very long. Attached to it is the printed charge of the Judge to the jury defining the law as to the rights of telephone companies with respect to house movers.

MR. DURANT—We have already received a printed copy of that opinion from somebody.

THE CHAIR—I think, then, if the Association agrees to it, that this paper had better be offered and printed as a part of the proceedings of this Association, to save the delay of reading. If that is your pleasure, gentlemen, it will be so ordered.

The paper was therefore filed with the Secretary, and is as follows:

AN INTERESTING JUDICIAL OPINION AS TO THE RIGHTS OF A TELEPHONE COMPANY AGAINST HOUSE-MOVERS.

Frequent demands have for several years back been made on the New York and New Jersey Telephone Company for removal of its wires to make way for buildings passing through the streets. Any individual desiring to move a building may apply to the local authorities for permission to do so, and almost invariably his wishes are granted and permit issued. Armed with this permit the house-mover presents himself a few hours before he reaches the point where the wires intercept him, and demands that they be removed. The position

heretofore taken by the Company was that while it was under no obligation to remove the wires without the payment of costs, yet as a matter of policy it was not deemed wise to stir up a sentiment which would surely be adverse to the corporation and favorable to the "poor house mover." As the number of pole routes increased and wires were from time to time added, these interruptions to the service become more and more aggravating, and the actual expense also became a matter for consideration, so that finally local managers were notified that no wires could be removed unless house-movers would guarantee the cost. In view of this decision, it may be interesting to other companies which have suffered from a similar annoyance to note the result of this move, and, in some measure, a test case which grew out of it.

In the month of October, 1887, the Company was notified by one Dexheimer of Orange, a house-mover, that he was about to move a building through Oakwood avenue, Orange, N. J., and in order to give free passage a telephone line of 78 wires and a 50 wire lead cable would have to be temporarily removed. At any price the Company would object to such an interruption as this would cause, but agreed to open the way upon a guarantee of payment of costs, which should not exceed, in any case, $25.00. Dexheimer stoutly refused to make the guarantee, assured by counsel that he had the necessary permit and that wires were an obstruction to the highway and might be removed by himself, if found in the way. On Sunday morning, October 30, 1887, the building had been brought within a few feet of the wires and neither the Company nor Dexheimer had changed their positions. It was not supposed that Dexheimer would cut the wires, but seeing that the Company made no move to clear the way he nipped them one by one with pliers and finally cut the cable, leaving a clear passage. The line slacked up badly for a distance of 10 or 12 poles on either side of the gap and presented a wretched appearance. The Company's counsel soon after brought suit against Dexheimer for damages, and the case came to trial before Judge Depue, in Essex Circuit Court. The ordinance of the city of Orange regulating the erection of telegraph lines, and of this ordinance the Company's counsel was not ignorant nor unmindful, directs that wires should not be strung over street crossings at a less height than twenty feet above the ground, and on this point the merits of the case seemed to turn. It was admitted by the Company that some of the wires were below the height required by the ordinance, but that at least thirty wires were above the twenty feet required. Inasmuch as these thirty wires were cut, Dexheimer had acted in violation of law and was liable for damages.

The Company's witnesses testified that the poles were at least twenty-five feet out of ground, and allowing the center of top arm to be eight inches from the top of pole and the center of second arm twenty-eight inches from top of pole, and still allowing twenty-four inches for a depression where poles stood below the level over which the wires were strung, it was claimed that the thirty wires were over twenty feet in height at the middle of span. The arms referred to were double ten-pin arms. Dexheimer, on the other hand, claimed that he cut all the wires while standing on the second floor of the building; that the timbers on which the building rested were three feet high, the first story nine feet, and his own height five feet ten inches. The jury rendered the

verdict that the Company was not entitled to damages, accepting Dexheimer's evidence as to height of wires rather than that of the Company's witnesses.

As the verdict appeared to be against the weight of evidence, motion for new trial was granted.

As the case stands now, however, *one* very gratifying result has been attained: the law as to use of public highways being clearly laid down in Judge Depue's admirable charge to the jury. Telephone companies have chartered rights, subject to local regulations. When these regulations have been complied with wires are not an obstruction under the law. Any interference with wires, under these circumstances, would make the house-mover accountable for damages.

Judge Depue's charge to the jury is submitted herewith in full.

H. G. McCULLY,
Assistant Superintendent,
NEW YORK & NEW JERSEY TELEPHONE COMPANY.

Essex Circuit Court.

THE NEW YORK AND NEW JERSEY TELEPHONE COMPANY
vs.
PETER DEXHEIMER.

JUDGE'S CHARGE TO JURY.

A person is not justified in cutting or breaking the wires of a telegraph or telephone company legally overhanging a public highway which may be an obstruction in the way of moving a house along the said highway.

Contra, if the wires are not legally over the highway.

This was an action brought for damages caused by the cutting of the plaintiff's telephone wires by the defendant in order to enable him to move a house along a highway.

DEPUE, J.—This is a case, gentlemen, of some novelty, and, so far as I am concerned, a case wholly of first impression; but inasmuch as it requires, in the decision of this controversy, the application of those principles of law which are well nigh universal, I think I shall have no difficulty in presenting it in such a way as to put you in possession of the legal rights of these parties. If I fall into error, I shall be very glad indeed to have that error repaired here or somewhere else.

The place at which the cutting was done was at a crossing of a public highway, a place at which the public had a right to pass and repass. It was a place, too, at which this company had a right to stretch its wires across and over the public highway for the purpose of engaging in the enterprise for which the company was established. This case, therefore, presents one of those questions that frequently arise where each of the parties have a right at the place in question, and the problem for consideration is what the measure of those rights is when the right of one is brought in conflict with the right of the other.

The defendant admits that on two occasions complained of he cut the wires of this company which extended across Oakwood avenue, and he claims that that act was justifiable in virtue of the rights that he had in that public highway as one of the public. If the case rested just here, I should feel constrained to charge the jury that the justification was not maintained. The object of a public highway is to accommodate the public for the purposes of such travel and intercourse as are required for public convenience and for the transaction of public business; and I should charge the jury that the use of a public highway for the purpose of travel in moving a building was not within the right which was enjoyable by the public in a public highway. I think there can be no difficulty about that. Where are you going to draw the line? What general obligation rests on the overseer of the highway on a public road to remove branches and projections over the road? Is he to remove them in such a way as to make a clear passage for anything which anybody sees fit to carry over a public highway? It is manifest that the application of such a principle, in virtue of the mere right of the public to use public highways for public purposes, would lead not only to the most onerous, but to the most absurd conclusions. Suppose this was in the country, and this building was to be removed for half a mile through a place where the trees projected with their limbs over the road, trees that had been there for centuries, and where they have not made the slightest interruption to the use of the public highway for the purposes for which it is required; if the overseer of the highway were called upon to remove those obstructions, would he be bound to do it? It seems to me that the attempt to bring the case within that principle must necessarily fail, for the reason that the defendant, in the sense that I am considering the rights of the public, was not using this public highway for the public, was not using this public highway for the purpose of travel; and in my judgment this case turns wholly on the construction of the 8th section of the company's charter, and on the ordinances of the city of Orange.

The first proviso in the 8th section is that "no poles shall be erected without the consent," etc., of the Common Council. (We must assume that this telephone wire was there lawfully.) "And that the same shall be so located as in no way to interfere with the safety or convenience of persons traveling on or over the said roads or highways." I have just disposed of that question. I have said that this use of roads and highways for the purpose of moving a house on them was not such a use as a person was entitled to make of a public highway.

Then the next question comes, "And that the use of a public street in any of the incorporated cities or towns of this State shall be subject to such regulations and restrictions as may be imposed by the corporate authorities of said cities or towns." Now, that the language has received a judicial construction which is broad enough to include the power of the city of Orange to pass ordinances on this subject—independent of that power to pass ordinances, in the exercise of the police power which is always lodged in municipal bodies of this character—and any ordinance that is reasonable and proper, any regulation which the Common Council may adopt on this subject which seems to be reasonable and proper; and it doesn't seem to be unreasonable or improper as a

legal exercise of the powers of the corporation ; and that the construction of a telegraph line in violation of such an ordinance and regulation is illegal, and therefore is subject to be removed by anybody who may use the public streets under permission given by the Common Council. The evidence shows that the defendant, when he engaged to remove this building, obtained the permission of the Common Council to remove it—a permission that gave him another sort of a right from that which inheres in every citizen in the use of the public streets for the purposes of a highway—a permission that wouldn't give him a right to remove the wires of this telephone company which were across the street and in his way, unless those wires were in the position they were in, in violation of an ordinance of the city of Orange. You will understand the difference between that right which pervades the whole State, and exists in every one of the public, with regard to the use of the highways, and a qualified right of the character of that which I have just mentioned. The ordinance, and the permission given by the Common Council of the city of Orange to this defendant to authorize him to remove this building, while it would give him the legitimate and reasonable use of the streets, would give him no right to remove the telephone wires of this company unless they were there in violation of the city ordinance.

An ordinance has been produced, which provides :

"(4.) All telegraphic or telephone wires shall be placed so as to hang not less than twenty feet above the street crossing."

Every wire erected by any telegraph or telephone company across the streets of the city of Orange that is less than twenty feet above the level of the street is in violation of that ordinance ; and such an erection becomes a nuisance, and anyone having occasion to use the public highway, whether he be a mere traveler. driving a wagon, or whether he be using it by permission of the Common Council in this way, would be justified in removing any wire that was less than twenty feet above the highway. So that the result of my view of the law and my instruction to the jury is that the permission of the Common Council to the defendant to remove this building affords him no justification for cutting the plaintiff's wires, unless they were wires that were in such a position and in such a location as to be less than twenty feet above the roadway. For all wires that are less than that distance the defendant's justification is complete. For all that are above that distance he is without justification, and is liable to respond in damages. So that the case depends altogether on that point—whether any of those wires were as much as twenty feet above the roadway. The testimony of the defendant is that all those wires were less than twenty feet above the roadway. He says that the building stood on timbers three feet above the ground; that the first story was a nine-foot story, and that he stood on the floor and reached up with the pliers and clipped all the wires that he loosened. Now, the nine-foot story, three-foot timbers, the spaces of the floor beams, the spaces above the height of a man, and the height that he could reach using the pliers, are the elemeuts from which you are to determine the result of his testimony with regard to height.

The testimony on behalf of the plaintiff is that all of these wires were less than twenty feet above the level of the ground except thirty, twenty of which

were on the upper cross-piece, and ten on the upper side of the second cross-piece; and the evidence on the part of the plaintiff is that, with regard to the wires that were cut on both these occasions the wires that were above twenty feet were the thirty wires that I have mentioned.

Now all I have to say is that with regard to all the wires that were above the line of twenty feet above the level of the street, the act of this defendant was unjustifiable. With regard to the wires that were below, his act is justifiable; because the Legislature, in incorporating this Company, made it subject to the legislation of the municipal authorities, and there is an ordinance on that subject. The amount involved in this cause is not great, but the principle is one of vast importance—the right of these companies to enjoy these franchises that are conferred by the act of the Legislature, and the right of the corporation, on the other hand, to exercise a reasonable control over every one of these corporations in the passage and adoption of ordinances designed for the purpose of regulating and providing for the convenient use of streets—questions that just now are of great importance in this State; and my instruction to you is that if you find that any of the wires that were cut were above the twenty feet you will find a verdict for the plaintiff, and an assessment of damages in such sum as, under the evidence, would represent the cost and expense of repairing those wires that were lawfully there; for the cutting of any wires that were below the twenty feet, my instruction to you is that the justification is complete.

MR. ECKERT—On behalf of the Metropolitan Telephone Company, I desire to extend an invitation to the members and delegates to visit our new building and the big switch-board, at any time during their stay. We shall take a great deal of pleasure in showing it to them.

THE CHAIR—Mr. Eckert, the General Manager of the Metropolitan Company, has just extended to you a cordial invitation to visit the new Metropolitan Building, No. 18 Cortlandt street, where he will be very happy to show you all the improvements that have been made in the telephone business in this city.

Pending the reading of the statistical report by the Secretary, the time might be profitably occupied by the discussion of any of the questions that have arisen in the papers that have been read before us. I shall be very happy to answer any questions in connection with the paper that I read.

MR. KER—The question of taxation by the boroughs, by the cities, by the townships and by the State, has caused the Pennsylvania Telephone Company a good deal of trouble.

I believe the law in Pennsylvania is in a mixed up condition, and it is probable that members of the Convention here could throw some light upon the subject which would assist us in determining what course we ought to pursue. The Pennsylvania law, I believe, as to the taxation authorized by boroughs, is that boroughs can only tax after the analogy of the taxation by the County Commissioners. The act signed by the Governor of Pennsylvania on the 24th or 25th of May, 1887, gave to certain cities the right to tax telegraph, telephone, electric light and power companies: that is to charge a license tax. There are, however, decisions by the Pennsylvania courts which show perfectly clearly that the plant of a corporation cannot be taxed. Notable among these is the Coatesville Company's decision, which is constantly cited by the Western Union and by other companies interested in the matter. It was there decided that this plant was capital and could not be taxed. Now, almost every city and borough in which our company is interested is trying to tax and is trying to institute a pole tax. The Western Union Telegraph Company has recently secured a decision of the Supreme Court of the United States that a pole tax (confirmed by the ruling of the Alabama Supreme Court), is illegal. I believe that is on the principle that the line is an interstate line, and the business an interstate business. However, there is another principle raised on which the Western Union Telegraph Company are now standing, and that is, that the boroughs and cities have a right to tax and to charge this license tax only on a police principle, and this license tax cannot be a tax per pole, but must be a tax on the telegraph property in proportion to the value which the telegraph property bears to the other property taxed on the police principle in the city. This has reduced the Baltimore and Ohio Telegraph Company's tax in one city, I am told by Mr. J. B. Stewart, Superintendent of that company in Baltimore, to the sum of thirty-nine cents, whereas the effort to tax was something like a dollar a pole. Now, if any company represented here in the Convention can name any principle which governs other States or the law of other

States, or which is established by the law of other States, which would form a precedent, as Pennsylvania law is undecided, it would be very useful. If any person, also, has seen any decision of the Supreme Court of the United States which is to the effect that the tax must be a tax on the police principle, and in proportion to the value that telephone or telegraph property bears to other city property, it would be very useful, because the establishment of such a principle by the Supreme Court of the United States would render it impossible for any city or borough to tax at so much per pole, and as the cities and boroughs are trying to tax at so much per pole it would be a very important thing for telephone companies to know whether we could not, on some legal basis established by the Supreme Court of the United States, contest that effort of the boroughs.

The only other question I have to ask is, that if there be not any such principle established by the Supreme Court of the United States, whether there be within the knowledge of gentlemen present any principle established by the Supreme Courts of other States which could form a precedent towards establishing the law in Pennsylvania? I take the liberty of asking you, Mr. Chairman, whether you will have the goodness to submit these questions to the room.

THE CHAIR—Gentlemen, you have heard Mr. Ker's remarks in relation to taxation in the State of Pennsylvania. Are there any remarks?

MR. GIFFORD—The matter has never been brought before the courts of the State of Kentucky. I suppose there are always some people in every legislature, who, from motives of patriotism, or some other ism, like to put a heavy tax on corporations. But we appeared before the Committee on Law and Taxation in the Kentucky Legislature and stated our case to them, and they decided to levy a State tax in this way: one-fourth of one per cent. upon our gross receipts in lieu of all other State taxes. While that is a little more than the average rate that other people have to pay on their property, we deemed it policy to consent to it, and it is the law; one-fourth of one per cent. in lieu of all other taxation.

In the State of Kentucky machinery in operation is not taxed, and our assessors have considered that our central office system, our bells, telephones and transmitters come under the head of machinery, and they are not taxed. I have been in the habit of going to the assessor and asking him what he thought the thing was worth, provided the patent was removed. I would say, "What would you give for those wires and poles around here?" He would say so many thousand dollars, and he taxed it that way, and we paid as we would on any other personal property at that rate. We also have a very reasonable business license. We are perfectly satisfied with it. It is about two and half times what the average license is. The city license in the city of Louisville is based upon one dollar on a thousand. At that rate our tax would be $125 or $150. They have assessed us a license tax of $250 a year. We thought it would not pay to quarrel with the municipal authorities for $125, and we acquiesced in that. We anticipate no trouble from the tax question there; but nothing of the kind has ever been brought before the courts.

MR. DURANT—I presume that every possible question that could arise under the various laws authorizing taxation has been raised in the State of Missouri and passed upon, and as a rule all those things go to the Supreme Court. But I regret that I am not able to give the gentleman any of the information which he seeks. The situation of our corporation is this: We pay a tax upon our personal property the same as any citizen of the State. In addition to that, the city of St. Louis is authorized by its charter to impose a license tax upon sundry callings, and it was a question whether they had that right to impose it on a telephone company. We concluded that it was very much better than a tax upon our poles, and when the matter was under consideration we concluded that we preferred that. The result was that we pay them an annual tax, paid semi-annually, upon our gross receipts—quite a considerable sum, and after 1890 it doubles.

MR. BAILEY—Do I understand the gentleman to say that

he pays a tax on his gross receipts to the city government as well as the State?

MR. DURANT—No; we pay the tax on our gross receipts to the State. We pay the tax on our personal property—it would be to the county, but as a matter of fact, the city of St. Louis is an independent locality by itself; it is not in any county. There is a county of St. Louis and a city of St. Louis, but they are independent organizations. The city of St. Louis used to be in the county of St. Louis, but by its special charter, adopted some twelve years ago, it is independent of the county. We pay the tax on personal property to the collector of taxes. We pay the tax on the gross receipts to the City Treasury; that is the gross receipts within the confines of St. Louis city.

MR. DRAKE—There are very simple methods of taxation in vogue in Iowa and Nebraska. In Nebraska the companies report their property direct to the State Auditor. The statements are laid before the Board of Equalization. They assess the property and then assign to each county its proportion. The county authorities then collect the municipal and State taxes. In Iowa, the State Board of Equalization fixes the assessments upon statements from the companies and levies the tax direct. The tax is paid to the State Treasurer and is in lieu of all other taxes of every description. No other city or county authorities have any right to levy any tax on any telephone or telegraph property.

MR. DURANT—Are you quite sure that no city in Nebraska has a right to impose a license tax?

MR. DRAKE—In Nebraska they have a right to license—what they call an occupation tax; that is a special prerogative bestowed upon municipalities—a tax upon the business, not upon the property.

MR. DURANT—Are those occupations specified in the charter of the city of Omaha?

MR. DRAKE—Yes, sir.

MR. DURANT—And the telephone and telegraph companies are omitted from the list?

MR. DRAKE—No, they are included in Nebraska. You, as an individual, may own a good piece of property on which you pay a special State and county tax. On that piece of property you are conducting a business. They will sell you a license to do a business in the town.

MR. DURANT—Why cannot they license you to do a telephone business in the city of Omaha?

MR. DRAKE—They do not in the city of Omaha, but they do in many of the towns and cities.

MR. DURANT—Then that license tax is in addition to the personal property tax?

MR. DRAKE—Yes.

MR. BAILEY—I would like for our President to give us some light on the tax question as to the States of Pennsylvania and Ohio.

MR. METZGER—I must confess that I did not hear the subject of this discussion; I did not hear what it was about; I was otherwise engaged. But it seems to me that the tax question is a political one, and I cannot see how or in what way this Association can affect the method or mode of taxation. In Pennsylvania, of course, we are taxed upon our gross receipts, and also upon the dividends. I think it is $\frac{8}{10}$ of one per cent. on our gross receipts, and then 3 mills upon every one per cent. of our dividends, based upon our capital stock. In the smaller towns of Pennsylvania we are not taxed for poles. In the city of Pittsburgh proper we are taxed for business purposes. That is all the tax that we pay for business purposes, and of course we are taxed at the same rate of taxation as all other classes of business, based upon the amount of sales or receipts. But there is no tax on poles or wires or telephones. In the State of Ohio they tax us on the poles. There they have a property tax. The tax is on the value of the plant, and they have sought of late years to tax us on the telephones, which we have resisted, and so far successfully, and we are taxed precisely the same as all other citizens are taxed, and we have been unable to find any reason to object to it. We do not know why we should object to it. We think that we are entitled to pay

our taxes just the same as a citizen who owns a house and lot, or, in fact, any other corporation.

In the State of Ohio we have no State tax. Of course we exist there by comity between the States under the rule that a corporation chartered in one State may transact business in another State. We have a town in the western part of our State called Newcastle. A member of the Council there did not pay his bill, and we brought him up with a round turn and compelled him to pay his bill. In the tax ordinance, he moved that the telephone companies pay $250 as a license tax. The electric light companies were taxed $125, the natural gas companies were taxed $125 and so on, depending upon the character of the business. We told the Council plainly that we would resist the payment of that tax: that they had no right to discriminate; that if they taxed us the same as they taxed all other companies on the same volume of business, that we would pay the tax: but that we were not going to pay $250 when the natural gas companies, whose revenue was ten times greater than ours, paid only $125. What the result of that case will be I don't know, but I am inclined to believe that the Council will modify their action, and tax us the same as they taxed the other companies. If they do not, we shall resist it by all legal means that we have at our command.

THE CHAIR—I take it that Mr. Ker wanted to get information as to the valuation of telephone property as a basis for taxation as much as anything else. It might be interesting to get views of members from various parts of the country on that. In my experience, I have had struggles with various assessors over their extravagant ideas of the value of poles and wires.

MR. GIFFORD—If that is the subject, I would say that we make our returns based on the original cost of the plant, and from that we deduct ten per cent. annually for depreciation, and we make that return under oath, because we believe that is a fair statement of the actual value of the plant.

MR. BAILEY—I would inquire if, in making those returns,

the President includes merely what we might term personal property and buildings. There was a law in Pensylvania that a corporation was free from local taxation, and was only subject to the general taxation law of the State. In Pennsylvania, I think, the great bulk of the entire State government was carried on by taxation of corporations. Railroads and other corporations—gas companies and water companies—have fought that all the way through, and uniformly with success. About a year ago or more there was, as Mr. Ker says, a law passed, allowing cities to tax telephones and telephone companies at a certain rate. We have never made any resistance to what they attempted to do. The generality of cities have levied what they call a police tax—a police franchise, and rather than bring up the question we have paid it cheerfully. Some of the smaller towns have attempted the same thing. So far, I have been able to throw them off the track by going and seeing the Council, generally the Council's attorneys, and arguing the question with them, with the uniform result of having them withdraw all the claims. There is one case that I have in mind, that, by agreement between our attorneys, was settled by a case stated; that is a question of law to be heard before a Judge of the Court of Common Pleas; that has not come up yet.

MR. METZGER—I would say in regard to Mr. Bailey's remark that there was an act passed in 1887, authorizing the creation of cities of the fourth, fifth, sixth and seventh class. That act gave express authority to Councils to levy a tax on telephone companies in the language of the act. It is under that act that these Councils are acting. The act does not fix any rate, however, but leaves it optional with the City Council as to what it shall be.

THE CHAIR—If there is no further discussion on the question of taxes, the time of adjournment is drawing very near, and I think we better hear the "Statistical Report" of the Secretary.

THE SECRETARY—As it lacks only fifteen minutes of the time of adjournment, I am afraid I could not get through with the reading of the report in that time, and that if I

did, no one else would be in the room to hear me. These figures, when read, are very difficult to follow and keep in mind, and, as they will all be printed, if is the pleasure of the Association, I would suggest that I have leave to report in print. If there is any special table that members desire to be selected and read, I can do so, perhaps, in a few minutes. Otherwise I would suggest that the whole report be printed first and read afterward.

MR. DRAKE—I move that such a course be adopted; that we read the statistics after they are printed.

The motion was seconded and carried.

The report is, therefore, printed as follows:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office,
NEW YORK CITY, September 1, 1888.

MR. PRESIDENT AND GENTLEMEN—In accordance with the provisions of the By-Laws which define the duties of my office, I have the honor to present the report upon "Exchange Statistics" for the year.

On the 9th of June last, I addressed the following circular to all the companies composing the membership of the Association, viz:

"NEW YORK, June 9, 1888.

"CIRCULAR:

"The work of preparing for the Annual Meeting of this Association, the Report formerly furnished by the Committee on Exchange Statistics, now devolves upon the Secretary. This report, covering as it does the important features in the operation of every exchange, has become more valuable each year for the purpose of comparison, and will farther increase in value and interest if the full co-operation of the several exchanges can be obtained in this work.

"It is requested that the blanks opposite the questions to be found on the inside pages of this circular, be filled up, and the report returned to this office by the 30th inst., in order to give sufficient time for work of compiling statistics. For the sake of uniformity it is suggested that the information as to number of daily connections, etc., be procured on the 20th, 21st and 22d of this month.

"The circumstances surrounding the operation of small exchanges differ so greatly as to afford no common basis of comparison, which is the object to be obtained, therefore no reports need be made from exchanges having less than 500 subscribers.

"Any additional blanks required, or explanation of the questions asked, will be cheerfully furnished.

"C. H. BARNEY,
"*Secretary.*"

In accordance with this request, reports have been received from 50 exchanges, representing 68,487 subscribers. These reports are received from 26 companies, 5 companies report as having no exchanges with over 500 subscribers, and 5 companies not reporting at all. That any company should fail to respond to the request is to be regretted, as the labor to have reported would have been but little, and the reports may prove of value to many of the members of the Association. The first report was received from the Central New York Telephone and Telegraph Company (Syracuse Exchange), on the 29th day of June, followed by those of the Pennsylvania Telephone Company on the afternoon of the same day. The results of the reports received will appear in a series of comparative tables.

Table No. 1 represents the number of subscribers, their increase from last year, and present ratio to inhabitants.

Thirty-four exchanges which reported last year and this, had in 1887, 49,052 subscribers. This year they report as having 54,363, a gain of 5,311 subscribers, or about 10 per cent. Washington made the greatest gain in numbers, 2,804, or a little over 48 per cent. New York shows a gain of 419, and Pittsburgh a gain of 332.

TABLE NO. 1.

EXCHANGE SUBSCRIBERS.

Cities.	Population.	Subscribers, 1888.	Increase over 1887.	Present Ratio, 1 to every	Subscribers in 1887.	Subscribers in 1886.	Subscribers in 1885.	Subscribers in 1884.	Subscribers in 1883.	Subscribers in 1882.
Albany, 1888.....	90,903	1,340	82	67	1,258	.....	.....	.....	.. .	.....
Atlanta...	37,400	960	98	38	862	.....	.....	.....	.....	.....
Baltimore, 1885 ..	417,220	2,261	156	184	2,105	1,863	1,630	1,450	1,220	1,017
Boston, 1885.....	390,593	2,288	158	174	2,130	1,847	1,696	.....	.....	.....
Brooklyn, 1888...	774,870	3,569	272	101	3,297	2,797	2,354	1,846	1,601	801
Bridgeport.....	29,148	614	.....	.....	.....	.....	.....	.....	.....	.....
Buffalo.....	155,000	1,797	30	431	1,767	1,702	1,533	1,420	1,208	1,047
Chicago	800,000	.....	.....	.....	4,577	4,067	3,630	3,246	2,903	2,596
Cincinnati	255,189	3,056	156	83	2,900	.....	.....	.....	.....	.....
Columbus.....	51,000	1,125	.....	46	.....	.....	.....	.....	.....	.....
Davenport	24,000	697	.....	34	.....	.....	.....	.....	.....	.....
Dayton.....	40,000	610	.....	65	.....	.....	.....	.....	.....	.....
Denver, 1885.....	57,000	945	105	60	840	779	751	723	680	620
Des Moines.....	40,000	726	.....	55	.....	.....	.....	.....	.....	.....
Detroit, 1887.....	239,265	2,853	268	84	2,585	2,285	1,956	1,700	1,474	.....
East Saginaw	43,140	632	69	68	563	517	.....	.....	.....	.....
Grand Rapids....	32,000	1,017	149	50	872	578	.....	.....	.....	.....
Hartford	42,551	868	44	49	824	.....	.....	.....	.....	.....
Jersey City.....	152,093	865	96	174	769	693	648	391	346	.....
Louisville.....	155,917	1,876	215	82	1,661	1,436	1,271	.....	.....	.....
Lowell	64,051	659	21	92	638	587	800	.....	.....	.....
Los Angeles	.....	1,018	.....	.....	.....	.....	.....	.....	.....	.....
Milwaukee, 1888 .	200,578	1,908	176	157	1,732	1,516	1,375	1,163	960	.....
Minneapolis, 1885.	129,200	.....	...	.....	1,387	.....	.....	.....	.....	.....
Newark	152.899	907	175	168	732	.....	.....	.....	.....	.....

EXCHANGE SUBSCRIBERS—*Continued.*

Cities.	Population.	Subscribers, 1888.	Increase over 1887.	Present Ratio, 1 to every.	Subscribers in 1887.	Subscribers in 1886.	Subscribers in 1885.	Subscribers in 1884.	Subscribers in 1883.	Subscribers in 1882.
New Haven*	69,032	1,212	.....	51	1,227	.....	.....	.....	.....	.....
New Orleans	216,140	1,158	10	180	1,148	1,100	1,163	.....	.....	.....
New York	1,206,299	7,300	419	165	6,881	6,043	5,252	4,808	4,158	3,451
Omaha	100,000	1,166	.....	.....	.....	.....	.....	.....	.....	.....
Paterson†	65,000	541	.....	120	642	640	651	551	473	....
Pawtucket	30,000	521	.....	.....	.....	.....	.....	.....	.....	.....
Peoria	37,632	.....	.....	.....	.....	.....	.....	.....	.....	.....
Philadelphia	847,170	2,564	144	330	2,420	.....	.....	.....	....	.....
Pittsburgh	251,432	2,618	332	96	2,286	1,951	1,688	.....	.....	.....
Portland, Maine	33,870	760	25	44	735	733	.....	.....	.....	.....
Portland, Oregon	20,000	530	.....	35	.....	.....	.....	.....	.....	.....
Providence‡	120,000	2,280	.....	52	2,417	3,168	2,802	1,892	1,745	.....
Reading	43,280	532	29	80	503	563	557	.....	.....	.....
Richmond	63,600	675	82	94	593	506	427	354	347	.....
St. Paul	111,000	.....	.....	.....	1,025	.....	.....	.....	.....	.....
St. Joseph	32,500	636	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco	300,000	2,732	.....	109	.....	.....	.....	.....	.....	.....
Scranton	45,850	679	62	67	617	573	.....	.....	.....	.....
Springfield, Ill	19,743	554	.....	35	.....	.....	.....	.....	.....	.....
Springfield, Mass.	33,340	606	41	55	565	535	.....	.....	.....	.....
Syracuse	80,000	805	.....	.....	.....	.....	.....	.....	.....	.....
Toledo	50,137	989	....,	50	.....	.....	.....	.....	.....	....
Utica	33,913	649	.....	.....	.....	.....	.....	.....	.....	.....
Washington	250,000	4,166	2,804	60	1,362	1,272	1,183	872	.....	.....
Wilkesbarre	30,000	593	66	50	527	463	.....	.....	.....	.....
Williamsport	25,000	515	49	46	466	437	.....	.....	.....	.....
Wilmington	50,000	578	78	86	500	440	.....	.....	.....	.....
Worcester	68,389	788	70	86	718	645	777	.....	.....	.....

* New Haven, decrease, 15. † Paterson, decrease, 101. ‡ Providence, decrease, 137.

The ratio of telephones to inhabitants is as follows: Davenport, Ill., leads with 1 to 34; Springfield, Ill., comes next with 1 to 35; Atlanta, 1 to 38; Portland, Me., 1 to 44; Wilkesbarre, 1 to 50; New Haven, 1 to 51. The country covered by these telephone exchanges is apparently well developed. Philadelphia has only one telephone to every 330 of its inhabitants, and Buffalo but one to every 431.

Table No. 2 shows the average number of daily connections. The business of 48 exchanges are shown and 33 will compare with last year. It will be seen that in the 33 exchanges which reported last year and this, the connections have increased from 273,139, in 1887, to 371,083 in 1888, an increase of 33,944 or 14 per cent. The increase this year is less than from 1886 to 1887. A remarkable increase is that of Baltimore, which has increased its number of connections from 19,275 last year, to 48,132 this year, a gain of 29,875. On the contrary, New York has decreased from 84,750 last year, to 64,352 the present year, a decrease of 20,398 connections, although it has gained 419 subscribers during the year.

TABLE No. 2.

DAILY CONNECTIONS.

	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	7,421	6,080						
Atlanta	10.175	8,517						
Baltimore	48,132	19,275	12,500	10,481				
Boston	1,400	17,345	12,043	10,385		4,741		
Brooklyn	18,821	17,508	14,675	10,809	5,508	5,290		
Bridgeport	3,509							
Buffalo	7,938	7,060	6,485	5,980	5,480	22,000	3,842	2,304
Chicago		44,292	32,996	31,368	27,101		16,044	16,136
Cincinnati	45,000	45,000				4,179		
Columbus	9,600							
Davenport	4,650							
Dayton	4,604							
Denver	5,938	5,230	4,528	4,467	5,298		3,450	
Des Moines	5,778							
Detroit	32,507	33,146	31,723	20,800				
East Saginaw	5,653	7,330						
Grand Rapids	7,497	6,800						
Hartford	4,006	3,692						
Jersey City	6,600	4,222	4,000					
Louisville	16,500	13,200	12,000					
Lowell	3,000	2,640	2,265					
Los Angeles	6,000							
Milwaukee	9,843	6,548	6,031	4,461				
Minneapolis		16,000						
Newark	3,996	2,705						
New Haven	5,500	6,253						
New Orleans	9,554	8,002	7,381	6,791				
New York	64,352	84,750	42,003	36,153	25,912	25,891	19.727	
Omaha	8,999							
Paterson	3,020	2,383	2,800					
Pawtucket	5,880							
Peoria	7,234							
Philadelphia	17,905	17,098						
Pittsburgh	16,000	18,492	14,435	11,583				
Portland, Me.	4,600	3,354						
Portland, Or.	2,000							
Providence	13,229	12,140	14,423	12,046				
Reading	3,268	2,239	2,500					
Richmond		7,651	4,307	4,072	3,013			
St. Paul		9,000						
St. Joseph	7,563							
San Francisco.	5,000							
Scranton	3,219	3,238						
Springfield, Ill	4,472							
Springf'd, Mass	2,783	2,471						
Syracuse	7,158							
Toledo	7,658							
Utica	2,731							
Washington	7,597	6,219	6,705	3,939	2,782			
Wilkesbarre	2,900	3,274						
Williamsport	2,608	2,600						
Wilmington	5,290	4,756						
Worcester	3,475	2,150	2,450					

Table No. 3 shows the average daily calls per subscriber, the use of the telephone being double the number of daily calls, as shown in the table. Forty-eight exchanges have reported, 30 of which can be compared with the year 1887. The greatest number of calls per subscriber in 1887 was shown in Cincinnati, Ohio, which was 15.5. This year the largest average is reported by Baltimore, Md., exchange being 12. calls per subscriber. Detroit shows 11.3, while Portland, Oregon, only shows 3.6 calls per subscriber. Of the 30 exchanges reported last year and this, 16 show an increase in the number of daily calls, 13 report a decrease, and two are exactly the same as last year.

TABLE NO. 3.

CALLS PER SUBSCRIBER.

Exchanges.	1838.	1887.	1886.	1885.	1884.
Albany	4.7	4.8			
Atlanta	10.5	9.8			
Baltimore	12.	9.1	6.7	7.	6.8
Boston	6.	8.1	6.5	6.	
Bridgeport	5.7				
Brooklyn	5.3	5.3	5.2	4.5	3.6
Buffalo	4.4	3.9	3.8	3.9	4.3
Chicago		9.6	8.1	8.6	3.4
Cincinnati	4.7	15.5	5.8	6.	7.3
Columbus	8.5				
Denver	6.2	6.2			
Detroit	11.3	12.8	13.8	10.6	
Davenport	6.7				
Dayton	7.5				
Des Moines	5.3				
East Saginaw	8.9	13.			
Grand Rapids	7.3	7.8			
Hartford	4.6	4.5			
Jersey City	7.6	5.4	5.7		
Lowell	4.5	4.1	3.8		
Los Angeles	5.8				
Louisville	8.7	7.9	8.3		
Milwaukee	5.1	3.7	3.9	3.2	
Minneapolis		11.5			
Newark	4.2	3.6			
New Haven	4.5	5.			
New Orleans	8.2	6.9	6.6	5.9	
New York	8.8	12.3	6.5	7.	5.1
Omaha	7.7				
Paterson	5.5	3.7	4.3		
Pawtucket	11.2				
Philadelphia	6.5	7.1			
Pittsburgh	6.1	8.1	7.3	6.8	
Portland, Maine	5.9	4.5			
Portland, Oregon	3.6				
Providence	6.5	5.	4.5	5.2	5.
Reading	6.	4.4	4.4		
Richmond		12.9	8.5	9.5	8.8
St. Paul		8.7			
St. Joseph	11.8				
Scranton	4.7	5.2			

CALLS PER SUBSCRIBER—*Continued.*

Exchanges.	1888.	1887.	1886.	1885.	1884.
Springfield, Mass.	4.5	4.3			
Syracuse	8.8				
San Francisco	1.8				
Springfield, Ill.	7.1				
Toledo	7.7				
Utica	4.2				
Washington	1.8	4.5	5.2	3.5	
Wilkesbarre	4.8	6.2			
Williamsport	4.	5.5			
Wilmington	9.	9.5			
Worcester	4.4	3.4	3.7		

Table No 4 shows the number of connections lost or delayed from such causes as "busy," "don't answer," and "in trouble."

Springfield, Ill., reports the largest percentage, being 23.2; Wilkesbarre comes next with 10.6 per cent.; New York this year reports 2.5 per cent. of lost or delayed connections.

TABLE NO. 4.

LOST OR DELAYED CONNECTIONS.

Exchanges.	1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Albany	368	4.9	465	7.6						
Atlanta	350	3.4	200	2.3						
Baltimore	1,224	2.5	1,224	6.3	900	7.2	900	9.	800	8.
Boston	38	2.			1,021	8.5	618	5.		
Brooklyn	1,375	7.5	1,363	7.8	817	5.6	506	5.	634	11.
Bridgeport										
Buffalo	755	9.5	527	7.5	421	6.5	446	7.	520	9.
Chicago			4,326	9.8	3,852	17.	2,759	8.7	1,355	5.
Cincinnati	700	1.5	500	1.1						
Davenport	173	3.7								
Dayton	3	6.5								
Denver			208	4.	186	4.1		.6		
Des Moines	300	5.2								
Detroit	2,808	8.6	3,209	9.7	2,100	6.6	2,120	10.		
East Saginaw	420	7.4	443	6.	263					
Grand Rapids	657	8.7	645	9.5	617					
Hartford			100	2.7						
Jersey City	174	2.6	269	6.4	200	5.				
Louisville, est'd	128	10.	est'd	10.	est'd	10.				
Lowell	300	10.	75	2.8	195	8.6				
Los Angeles										
Milwaukee	42	4.2	994	15.2	2,052	34.	892	20.		

LOST OR DELAYED CONNECTIONS—*Continued.*

Exchanges.	1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Minneapolis	.....	.....	1,600	10.	.....	.....	.....	.....	.....	.....
Newark	20	0.55	40	1.5	.....	.....	.....	....	.....	.....
New Haven	150	2.7	950	15 2	.....	.....	.....	....	.....	.....
New Orleans	440	4.6	450	5.6	600	8.1	426	6.5	.....	.....
New York	1 639	2.5	443	.5	2,180	5.5	1,959	5.	1,789	8.
Omaha	260	2.9	.....	.....	.....	.....	.....	.....	.....	.....
Peoria	398	5.5	.....	.....	.....	.....	....	.....	.....	.....
Paterson	70	2.2	216	9.1	125	4.5	.....	.....	.....	.....
Pawtucket	.....	.....	....	.....	.....	.....	....	.....	.....	.....
Philadelphia	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pittsburgh	1,140	7.	1,735	9.4	1,397	9.7	1,085	10	.....	.....
Portland, Me	450	....	263	7.8	238	.....	.....	.....	.....	.....
Portland, Oregon	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Providence	.....	.....	.....	...	.....	.....	.....	.....	.....	.....
Reading	500	10.5	268	12.0	150	.6	.....	....	.....	.....
Richmond	.....	.....	.....	.....	.....	....	.....	.....	.....	.....
San Francisco	.....	.....	....	.....	.....	.....	.....	.....	.....	.....
St. Paul	.....	....	900	10.	.....	.....	.....	.....	.....	.....
St. Joseph	.....	....	.....	.....	.....	.....	.....	.....	.....	.....
Scranton	289	8.9	171	5.3	195	.....	.....	.....	.....	.....
Springfield, Ill	1,040	23.2	.....	.....	.....	.....	.....	.....	.....	.....
Springfield, Mass	183	6.5	119	4.8	113	.....	.....	.....	.....	.....
Syracuse	.....	.. .	.....	.....	.....	.....	.....	.....	.....	.....
Toledo	760	9.6	.....	.....	.....	.....	.....	....	.....	.....
Utica	268	9.8	.....	.....	.....	.....	.....	.....	.....	.....
Washington	634	8.3	576	9.3	738	11.	777	1.9	602	20.
Wilkesbarre	619	10.6	175	5.3	62	.....	.....	.....	.....	.....
Williamsport	266	10.2	250	9.6	158	.....	.....	.....	.....	.....
Wilmington	.....	.....	234	4.9	.....	.....	.....	.....	....	.....
Worcester	275	7.9	175	7.1	125	5.1	.....	.....	.....	.....

Table No. 5 exhibits the average number of connections made daily by each subscriber operator, from 8 A. M. to 6 P. M., forty-eight exchanges having reported. According to the table it will be seen that the operators at Des Moines do the greatest amount of work, and Brooklyn the least. The former exchange shows an average of 1,651 connections, and the latter only 214. Twenty-three exchanges, operating the multiple system, average 631 connections per day by each operator, and twenty exchanges using the straight board average 547 daily connections per operator. The majority of the exchange operators seem to be doing more work than in 1887, but in Atlanta, Brooklyn, Denver, Detroit, East Saginaw, Hartford, Jersey City, Lowell, New York, Pittsburgh, Scranton, Washington and Wilmington the reverse appears to be the case.

TABLE No. 5.
CONNECTIONS PER OPERATOR.

Exchanges.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	449	429						
Atlanta	608	746						
Baltimore	1,132	788	595	390				
Boston		788	514	375				
Brooklyn	214	384	367	277	177	132		
Bridgeport	394							
Buffalo	276	269	233	233	221	263	148	
Chicago		328	300	290	271	202	161	
Cincinnati	650	522						
Columbus	788							
Davenport	500							
Dayton	685							
Denver	315	319	269	291	360	379	246	
Detroit	676	942	709	710				
Des Moines	428							
East Saginaw	319	732	643					
Grand Rapids	485	469	372					
Hartford	293	310						
Jersey City	265	388	400					
Louisville	674	612	633					
Lowell	438	440	324					
Los Angeles								
Milwaukee	468	345	335	281	203	269		
Minneapolis		960						
Newark	215	116						
New Haven	308	338						
New Orleans	1,127	1,073	1,054	848				
New York	647	895	200	225	145	120	114	
Omaha	649							
Paterson	437	303	400					
Pawtucket	728							
Peoria	541							
Philadelphia	469	465						
Pittsburgh	330	569	504	526				
Portland, Me.	400	305	327					
Portland, Or.	330							
Providence	692	301	280	335				
Reading	453	334	355					
Richmond		1,028						
San Francisco								
St. Paul		304						
St. Joseph	1,101							
Scranton	402	405	620					
Springfield, Ill.	584							
Springfi'd, Mass	306	305	293					
Syracuse	988							
Toledo	765							
Utica	390							
Washington	521	530	637	387				
Wilkesbarre	580	444	469					
Williamsport	522	325	401					
Wilmington	881	910						
Worcester	326	237	306					

Table No. 6 gives the number of wires which each operator is expected to attend. Twenty-three multiple boards show an average of 74 wires per operator.

Twenty straight boards average 59 wires per operator. In both cases this is an increase over 1887.

TABLE NO. 6.

SUBSCRIBER'S WIRES PER OPERATOR.

Exchanges.	1888.	1887.	1886.	1885.	1884.	1883.
Albany	83	77				
Atlanta	75	85				
Baltimore	66	98	67	71	85	30
Boston	90	95	88	63		
Brooklyn	70	74	72	71	68	48
Bridgeport	39					
Buffalo	63	62	57	70	67	67
Chicago		34	37	33	34	31
Cincinnati	53	37				
Columbus	100					
Davenport	100					
Dayton	100					
Denver	53	52	48			
Des Moines	90					
Detroit	39	76	71	70		
East Saginaw	38	38	55			
Grand Rapids	43	60	57			
Hartford	28	33				
Jersey City	46	58	64			
Louisville	100	71	70			
Lowell	33	42	37			
Los Angeles	150					
Milwaukee	78	76	71	91	64	46
Minneapolis		62				
Newark	54	46				
New Haven	30	73				
New Orleans	153	157	142	144		
New York	79	84	91		66	
Omaha	100					
Paterson	74	76	75			
Pawtucket	26					
Peoria	100					
Philadelphia	60	56				
Pittsburgh	50	65	62	65		
Portland, Me	33	38	37			
Portland, Oregon	100					
Providence	51	28	35	35		
Reading	54	57	44			
Richmond	83	84	128	108	88	
St. Paul		38				
St. Joseph	100					
Scranton	38	32	47			
Springfield, Ill	100					
Springfield, Mass	31	71	67			
Syracuse	80					
Toledo	95					
Utica	79					
Washington	79	80	79	126		
Wilkesbarre	45	34	53			
Williamsport	53	44	64			
Wilmington	89	90	92			
Worcester	35	34	34			

Table No. 7 shows the cost of making connections in 39 exchanges. The most noticeable feature in this Table is the remarkable increase in the case of Williamsport, which has increased from .0048 in 1887 to .035 the present year.

TABLE NO. 7.

COST OF CONNECTIONS.

Exchanges.	Cost of One Connection.						
	1888.	1887.	1886.	1885.	1884.	1883	1882.
Albany	.00227	.0026					
Atlanta	.0034	.0029	.1				
Baltimore		.0013	.0045	.0025	.0040	.0058	.0072
Boston			.0166	.0038			
Brooklyn	.004	.0041	.0040	.0041	.0069	.0098	
Bridgeport	.007						
Buffalo	.00518	.0053	.0057	.0064	.0060	.0047	.0072
Chicago		.0040	.0056	.0048	.0054	.0064	.0073
Cincinnati							
Columbus	.003						
Denver	.00531	.0055	.0061				
Des Moines	.1.2						
Detroit	.0017	.0014	.0016	.0021			
East Saginaw	.0037	.0025	.0020				
Grand Rapids	.003	.0024	.0052				
Hartford	.0091	.0043					
Jersey City	.0034	.0043	.0050				
Louisville	.0024	.0026	.0033				
Lowell	.006	.0063	.0063				
Milwaukee	.0026	.0032	.0035	.0046	.0113	.0055	
Minneapolis		.0016					
Newark	.0055	.0060					
New Haven		.0066					
New Orleans	.001	.0018	.0011	.0015			
New York	.0042	.0078	.0083	.0066	.0066		
Omaha	.029						
Paterson	.0036	.0056	.0050				
Peoria	.2.3						
Philadelphia	.005	.0037					
Pittsburgh	.0041	.0031	.0035	.0051			
Portland, Me	.0026	.0071	.0078				
Portland, Oregon	.005						
Providence							
Reading	.0048	.0047	.0020				
Richmond	.323	.0023					
Saint Paul		.0028					
San Francisco							
St. Joseph	.025						
Scranton	.03⅓	.0046	.0034				
Springfield, Ill	.0025						
Springfield, Mass	.0044	.0052	.0060				
Syracuse	.0015						
Toledo	.0035						
Utica	.0052						
Washington	.003	.0037	.0031	.0051			
Wilkesbarre	.002	.0045	.0028				
Williamsport	.035	.0048	.0034				
Wilmington		.0020	.0026				
Worcester	.0047	.0089	.0073				

Table No. 8 gives the number of trunk lines. It will be seen by referring to this table that these lines are increasing year by year.

TABLE No. 8.

NUMBER OF TRUNK LINES.

Exchanges.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
Albany	24	24	....	....	....	...	....
Atlanta	3	....	....	....	....	....	....
Baltimore	20	18	17	....	....	....	....
Boston	177	213	183	152	....	....	....
Brooklyn	239	221	175	126	104	89	....
Bridgeport	13	....	....	....	....	....	....
Buffalo	59	57	57	45	37	26	21
Chicago	....	369	366	355	254	245	228
Cincinnati	261	260	....	....	....	....	....
Davenport	17	....	....	....	....	....	....
Dayton	15	....	....	....	....	....	....
Denver	....	....	....	....	....	....	....
Detroit	50	37	30	20	....	....	....
East Saginaw	12	10	4	....	....	....	....
Grand Rapids	....	....	....	....	....	....	....
Hartford	18	16	....	....	....	....	....
Jersey City	84	69	67	....	....	....	....
Louisville	11	12	2	....	....	....	....
Lowell	12	12	12	....	....	....	....
Los Angeles	...	....	....	....	....	....	....
Milwaukee	....	...	....	....	....	....	....
Minneapolis	....	14	....	....	...	...	....
Newark	41	23	....	....	....	....	....
New Haven	19	20	....	....	...	...	....
New Orleans	....	....	....	....	...	....	....
New York	742	755	600	520	491	331	274
Omaha	...	....	....	....	....	....	....
Paterson	17	21	26	....	....	....	....
Pawtucket	19	....	....	....	....	....	....
Philadelphia	62	60	....	....	....	....	....
Pittsburgh	82	78	47	39	....	....	....
Portland, Me	5	5	6	....	....	....	....
Portland, Oregon	....	....	....	....	....	....	....
Providence	47	39	32	37	42	38	48
Reading	5	9	5	....	....	....	....
Richmond	1	....	....	....	....	....	....
San Francisco	43	....	....	....	....	....	....
St. Paul	....	16	....	....	....	....	....
Scranton	1	2	2	....	....	....	....
Springfield, Mass	15	13	12	....	....	....	....
Utica	16	....	....	....	....	....	....
Washington	13	4	5	....	....	....	....
Wilkesbarre	5	7	7	...	....	....	....
Williamsport	4	....	2	2	....	...	....
Wilmington	8	6	6	....	....	....	....
Worcester	23	12	8	....	....	....	....

Table No. 9 shows the daily connections by trunk lines. Last year 26 exchanges showed an average of 39 connections per day over each trunk line. This year 32 exchanges show a daily average of 45 connections.

TABLE No. 9.

TRUNK CONNECTIONS.—DAILY CONNECTION PER TRUNK.

Exchanges.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	10	18						
Atlanta	30							
Baltimore	13	12	26					
Boston		27	24					
Brooklyn	29	22	25	33	28			
Bridgeport	46							
Buffalo	31	26	26	36	39	50	41	21
Chicago		75	61	56	38			
Cincinnati	42	38						
Davenport	57							
Detroit	44	155	61	52				
East Saginaw	81							
Hartford	75	9	9					
Jersey City	19	13	13					
Louisville	50	40	40					
Lowell	136							
Minneapolis		15						
Newark	15	16						
New Haven	11	27						
New York	32	43	56	48	31	41	31	23
Paterson	15	10	10					
Philadelphia	16	36						
Pittsburgh	54	69	74	111				
Portland, Me	54	8	11					
Portland, Oregon	12							
Providence	88⅛							
Reading	2	76	4					
San Francisco	40							
St. Paul		18						
Scranton	10							
Springfield, Mass.	9	13	9					
Washington	78	16	8					
Wilkesbarre	173	25	30					
Williamsport	25	48	41					
Wilmington	38	22						
Worcester	75	80						

Table No. 10 gives the proportions of direct and circuit wires in 49 exchanges. Last year thirty-seven exchanges reported 31,921 direct and 6,239 circuit wires. Fifty exchanges this year reports 47,927 direct and 6,812 circuit wires.

The proportion of circuit wires is naturally growing smaller year by year.

TABLE NO. 10.

DIRECT AND CIRCUIT WIRES.

Exchanges.	1888. Direct.	1888. Circuit.	1887. Direct.	1887. Circuit.	1886. Direct	1886. Circuit.	1885. Direct.	1885. Circuit.
Albany	1,130	65	1,087	60				
Atlanta	907	13	821	10				
Baltimore	1,197	464	1,078	372	1,007	404	831	388
Boston	2,223	31	2,056	34	1,769	36	1,606	44
Brooklyn	2,944	195	2,705	170	2,157	195	1,734	237
Bridgeport	169	106						
Buffalo	1,272	179	1,258	174	1,185	183	1,102	165
Chicago			4,577		4,067		3,630	
Cincinnati	2,351	309	2,222	299				
Columbus	1,005	42						
Davenport	655	12						
Dayton	562	12						
Denver	853	39	740	44	717	9	715	10
Des Moines	726							156
Detroit	2,282	244	2,060	231	1,821	189	1,605	
East Saginaw	479	55	345	153	390	53		
Grand Rapids	892	41	738	48	638	45		
Hartford	170	200	176	193				
Jersey City	433	150	442	143	385	131	350	127
Louisville	1,077	347	776	434	675	372	730	371
Lowell	90	206	82	173	32	227	52	221
Los Angeles	922	44						
Milwaukee	1,435	208	1,311	179	1,172	104	986	112
Minneapolis			579	287				
Newark	858	3	697	2				
New Haven	226	274	214	261				
New Orleans	1,002	73	1,034	47	995	73	975	84
New York	7,298	2	6,842	8	6,004	6	5,213	6
Omaha	1,166							
Paterson	353	93	433	99	441	92	459	91
Pawtucket	36	149						
Peoria	539	1						
Philadelphia	2,040	130	1,897	132				
Pittsburgh	2,001	229	1,738	210	1,457	205	1,120	173
Portland, Me	98	267	45	316	37	329		
Portland, Or	510	4						
Providence	337	646	322	675	340	944	324	616
Reading	164	160	104	240	145	184	147	233
Richmond	660	6	580	6	490	9		
San Francisco	2,075	263						
Saint Paul			469	210				
St. Joseph	623	6						
Scranton	87	184	84	168	69	164		
Springfield, Ill.	553	1						
Springf'd, Mass	51	190	41	162	52	145		
Syracuse	541	129						
Toledo	936	17						
Utica	551	36						
Washington	524	331	478	300	444	270	292	314
Wilkesbarre	142	83	128	73	119	91		
Williamsport	111	154	114	152	105	151		
Wilmington	496	36	433	17	372	33		
Worcester	72	253	57	215	78	192	88	185

Table No. 11, salaries of operators, is taken from 50 exchanges and 1,264 op tors. New York pays the highest salary, being $21.92 weekly, and Reading the l est. The average being $6.39 as against $6.02 last year.

TABLE NO. 11.

SALARIES OF OPERATORS.

50 Exchanges, 1,264 Operators.	Wee Sala
Highest (including Chief Operator)	$21
Lowest	2
Average	6

Table No. 12 shows the wages paid to line, instrument and combination m This report is taken from 40 exchanges, employing 264 men.

TABLE NO. 12.

SALARIES OF LINE AND INSTRUMENT MEN.

Forty Exchanges—264 men.	Daily Pay of					
	Line Men.		Instrument Men.		Comb'n Men.	
Highest	Brooklyn	$3.27		$2.88	Denver	$3
Lowest	Dayton	1.34	Richmond	77	Williamsport	1
Average		1.97		1.33		1

In conclusion, the Secretary desires to thank the officers of the compan which have made the reports upon whch the above tables were based, and to c gratulate the Association that 50 exchanges owned by 26 companies reported year as against 37 exchanges owned by 22 companies, which sent in statements year. May next year make a still more complete showing!

Respectfully submitted,

C. H. BARNEY,
Secretary

THE CHAIR—Is there any further business before the As ciation?

THE SECRETARY—I think it is necessary that the Executi Committee should be empowered to fix the time for the ne meeting.

MR. DRAKE—I offer a motion to that effect, and would li to inquire if the Executive Committee have considered

TABULA

	Multiple.							
	"							
	"							
	Straight.							
	"							
	Multiple.							
	"							
	Straight.							
	Multiple.							
	Straight.							
	"							
	"							
	Multiple.							
	"							
	"							
	Straight.							
	"							
	Multiple.							
	Both.							
	Multiple.							
	Straight.							
	"							
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	Both.							
	"							
	Straight.							
	Multiple.							
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	"							
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	"							
	Multiple.							
	"							
	"							
	"							
	"							
	"							
	Straight.							
	"							

Albany	80,000	1	1	Western E. ric Co.
Attleboro	17,000	1	2	law
Fitchburg	417,220	...	1	Western Electric Co
Lowell	280,000	2	1	" " "
Lynn	77[illegible],500	4	1	" " "
Lynn	185,000	3	1	" " "
[illegible]	20,000	.....	1	" " "
[illegible]	95[illegible],000	.....	1	" " "
[illegible]	31,000	1	1	" " "
[illegible]	24,000	3	1	
[illegible]	10,000	1	1	Western Electric Co.
Lynn	7[illegible],000	1	1	Supplied Outlined.
New Bedford	40,000	1	1	
[illegible]	280,000	3	1	Western Electric Co
[illegible]	40,000	2	1	Detroit Electrical Works.
[illegible]	40,000	1	1	" " "
[illegible]	42,000	.....	1	Western Electric Co.
Quincy (Tide	120,000	2	both	" " "
Lowell	60,000	.....	1	(Thos. Wilkins.
La Crosse	.....	.....	1	Western Electric Co.
Lancaster	150,000	3	1	" " "
Meriden	200,000	1	1	" " "
Newark	150,000	...	1	" " "
New Haven	60,000	3	1	" " "
New Orleans	250,000	.....	1	" " "
New York	2,500,000	10	both	" " "
Omaha	100,000	1	1	" " "
Paterson	60,000	2	both	" " "
Pawtucket	30,000	.....	both	Brockbridge.
Peoria	40,000	.....	1	Western Electric Co
Philadelphia	500,000	.....	both	
Pittsburg	250,000	10	1	W. E. Co. C. K. Jones &
Portland, Me	33,870	.....	1	Chas. Winslow.
Portland, Or	20,000	1	...	Western Electric Co.
Providence	120,000	7	both	" " "
Reading	40,000	1	1	" " "
Richmond	60,000	1	2	law.
Rochester	30,000	...	1	Western Electric Co
San Francisco, Cal	300,000	5	1	" " "
Scranton	40,000	...	1	" " "
Springfield, Ill	10,000	1	1	" " "
Springfield, Mass	25,000	...	1	" " "
Syracuse	80,000	.....	1	" " "
Toledo	60,000	...	1	" " "
Utica	32,000	2	1	" " "
Washington	200,000	1	1	" " "
Wilkesbarre	30,000	...	1	" " "
Williamsport	25,000	2	1	" " "
Wilmington	30,000	.....	1	" " "
Worcester	60,000	.....	1	" " "

advisable to call another executive session of this assembly, as they were given power yesterday to do.

MR. METZGER—There has been no action to that effect on the part of the Executive Committee. As we understood the action of the Association yesterday, it was decidedly adverse to holding what might be termed secret sessions, and hence it was not necessary to call the Association together again as a committee of the whole. Mr. Tyler offered an amendment to the original resolution on that subject, and he was to present the amendment to-day, but the Association has not had the pleasure of having that amendment before it, so nothing more has been done. I presumed that the action of the meeting yesterday in deciding that executive sessions were not the proper thing, was really the voice of the Association.

Mr. Chairman, if there is no further business on hand, I move we adjourn *sine die*.

THE CHAIR—Mr. Drake's motion is before the house, Mr. Metzger—the motion to empower the Executive Committee to select a date for our next annual meeting at Minneapolis.

Mr. Drake's motion was carried.

Mr. Metzger's motion was then renewed and carried.

THE CHAIR—The motion having been carried, I declare the meeting adjourned *sine die*.

C. H. BARNEY,
Secretary.

The next meeting of the Association will be held in Minneapolis at a date to be hereafter fixed by the Executive Committee.

APPENDIX A.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 5, 1888.

The Committee met at the Hotel Brunswick, New York City, at 3 P. M. Present, President Metzger, Messrs. Denver and Cutler.

It was voted to instruct the Secretary to drop from the rolls of the Association the names of the Cumberland Telephone and Telegraph Co., and the East Tennessee Telephone Co., those organizations having resigned, and that of the Clark Insulated Wire Co., it having ceased to exist. This action was taken by virtue of the power to act, voted to the Committee by the Association at the morning session of September 4th.

It was voted to reappoint C. H. Barney as Secretary, at the same salary as last year. It was voted to allow the Nebraska Telephone Co. to circulate copies of T. D. Lockwood's paper read before the Association, in advance of the printed proceedings. The Committee adjourned until Thursday, September 6, 1888.

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 6, 1888.

The Committee met on the steamer Cygnus, on the Hudson River, at 3 P. M. Present, President Metzger, Messrs. Bryan and Denver.

The Treasurer's report for the past year was audited and found correct.

It was voted to instruct the Secretary to furnish printed copies of the proceedings *to members of the Association only.*

There being no further business, the Committee adjourned.

C. H. BARNEY,
Secretary.

APPENDIX B.

ENTERTAINMENTS PROVIDED FOR THE MEMBERS OF THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION WHILE IN NEW YORK.

The Tenth meeting of the Association will long be memorable by reason of the hospitality extended to the visiting delegates. The following extracts from the electrical journals of September 15, 1888, will give an idea of the various entertainments which were provided for them, all of which were thoroughly enjoyable.

(From the *Electrical Review.*)

HOW THEY WERE ENTERTAINED.

THE TELEPHONE MEN RECEIVE MOST HOSPITABLE TREATMENT WHILE IN NEW YORK.

The visiting telephone men who spent last week within the charmed precincts of Manhattan Island had a very enjoyable as well as profitable time. The Convention continued for two days, and the hard work of the second day was made amends for by the entertainment that followed. The first relaxation came Tuesday evening, and was the kindly gift of the American Bell Telephone Company. This consisted of a theatre party at Niblo's, which was arranged and managed by Mr. Thomas B. Doolittle on behalf of the parent company. The telephone men attended in full force, all wearing the little gold badges, in the shape of a telephone receiver, that by thoughtfulness of Secretary C. H. Barney had been provided. The other theatre-goers that night were at a loss to know the meaning of the presence of such a fine-looking body of men, each one decorated with the telephone pin. The next day at 3.30 P. M., the American Telephone and Telegraph Company brought seven tally-ho coaches to the Hotel Brunswick, which were soon covered with the telephonists, and a very delightful drive through Central Park, Riverside Park and along the Boulevard was enjoyed. The drive included a visit to the lines of the company, built for long distance use between New York and Boston, and the splendid construction was greatly admired. The ride was a very happy thought, and many were the compliments bestowed on General Manager Ed. J. Hall, of the A. T. & T. Company, for his considerate act in giving the visitors a scenic treat that they will never forget.

A visit to the tomb of General Grant was taken, and at 6.30 P. M. the party arrived at the new Mt. St. Vincent restaurant, Central Park, where a photograph was taken on the lawn. It was here that the Western Electric Company designed to show its appreciation of the visiting telephonists, and at 7 o'clock invited them to sit down to an elaborate banquet. The menus were charming little works of art, each with a different and appropriate Shakespearian quotation in gilt on the cover.

Mr. H. B. Thayer, the manager of the Western Electric Company, New York, presided, with President Metzger, Theo. N. Vail, and Ed. J. Hall, Jr., on his right, and Mr. C. Jay French, Secretary C. H. Barney and Toastmaster Chas Dutton, on his left. There were present about 150 persons and the banquet continued from 7.15 to 11.30, concluding with a number of toasts. The speakers were C. Jay French, Morris F. Tyler, Geo. F. Durant, Chas. Glidden, T. D. Lockwood, W. J. Sefton, D. L. Gibbons, F. W. Jones, H. L. Storke, R. W. Pope, W. A. Hovey and others. The remarks were all well received and applauded. Mr. Tyler, as usual, made a capital speech, and spoke words of praise for the Bell Company and its great victory in the courts, stating that the legal contest has been the most magnificent ever waged. In the course of Mr. Gibbens' remarks, he paid a compliment to Mr. T. N. Vail, and the audience seemed to go wild. For several minutes the cheering and applause continued. It was a splendid reception, and one that must have proven to Mr. Vail that he was still the owner of a very warm place in the hearts of the telephone men. The banquet concluded with cheers for the Western Electric Company and its able and greatly liked New York manager, Mr. H. B. Thayer. The tally-ho coaches carried a lively party down to the Brunswick, arriving there about the midnight hour.

The Metropolitan Telephone and Telegraph Company presented a day and an evening of entertainment that will for many years remain fresh in the minds of the participants. The iron steamboat "Cygnus" was chartered for Thursday, and at 11 o'clock left the city, loaded with telephone men and several ladies, and steamed up the beautiful Hudson. To the majority it was a new and interesting scene. At 1 o'clock a most elegant lunch, furnished by one of New York's leading caterers, was set out, and the voyagers did it full justice. The return was made to reach Staten Island by 6 P. M., and time was had for a ride down New York Bay, past the Goddess of Liberty and beyond the Narrows.

The time on the boat was most enjoyably spent, Mr. W. H. Johnstone, the inventor of the conduit system that bears his name, aiding in the pleasantness of the occasion by his aptness in calling toasts. President Vail, General Manager Eckert, Treasurer A. S. Dodd, Electrician Seeley, of the Metropolitan Company, were remembered with hearty toasts and applause, and were complimented in a way that should make them feel good for at least a year.

The dinner at 6 o'clock at the St. George Casino was a fine affair indeed, and was enjoyed by about 200 persons. Mr. T. N. Vail presided. The speakers after the dinner were Gen. H. A. Barnum, Commissioners Jacob Hess and D. L. Gibbons, A. B. Chandler, Erastus Wiman and others, and the telephone and the Metropolitan Company and Mr. Vail again received high praise.

The great spectacular play, the " Fall of Rome," to which complimentary tickets had been furnished by the same generous company, concluded the day's entertainment, unless the jolly ride from Staten Island back to New York should be named as part of the programme.

The day had been greatly enjoyed, and our visiting telephone men can certainly have but the most kindly thoughts of their brief sojourn in New York City.

(From the *Electrical World.*)

An extremely enjoyable part of the Convention was the long distance entertainment given by the American Telegraph and Telephone Company on Wednesday, supplemented by the dinner tendered by the Western Electric Company. Six tally-ho coaches started from the Hotel Brunswick at 3.30, and with a load of passengers inside and out made their way up Fifth avenue, through the Park to Seventy-second street, thence to Riverside Drive up to Grant's tomb. There the party dismounted to inspect the tomb and the surroundings; and as the visitors looked down from the high bluff through the trees and the lawns to the winding Hudson below, they agreed that at least no lovelier spot could have been found for the great warrior's resting place. Remounting, the party proceeded by the Boulevard to 155th street, having an opportunity on their way to admire the beautiful long distance lines running up that way, and then they came back to the Park by St. Nicholas avenue, 125th street, Seventh avenue and 110th street. On arriving at the Mount St. Vincent Hotel, the excursionists were photographed in a group on the lawn at the back of the house. A pleasant half hour was spent in discussing the various incidents of the drive which the American Telephone Company had given, and then came the call to dinner, which was served in the large banqueting hall at the southern end. Mr. Thayer, the well-known representative of the Western Electric Company, took the chair, supported by Messrs. Metzger, Barney, T. N. Vail, Sargent and Storke, and at the ends of the two longest tables sat Mr. Brown and Mr. Patterson. An excellent dinner was served in first-class style, accompanied by four wines, etc., and Mr. Thayer having said a few hearty words of welcome on behalf of the Western Electric Company, Mr. Dutton assumed his duties as toastmaster. Mr. C. Jay French responded briefly for the American Bell Telephone Company, and presented the regards and kind wishes of such of its officers as were absent. Mr. Morris F. Tyler then spoke to the toast of the Eastern licensees of the parent company, and referred very eloquently to the benefits that the telephone conferred on the public. He also reminded his hearers that their business to-day was based, as a valuable property, on one of the most magnificent fights ever seen in the courts anywhere in the world, and though the fight had been made with the licensees' own money [laughter] the parent company had made it successfully, with no little skill, no little shrewdness, no little stern confidence in the justice of their cause. Mr. George F. Durant then responded humorously for the Western licensees, and Mr. C. J. Glidden replied for the Erie Company, representing interests in other sections. Mr. T. D. Lockwood spoke with his accustomed humor and vivacity on the subject of the telephone, and hit off neatly the characteristics of many of the famous 37 men who had all invented the telephone before Prof.

Bell did. He quoted aptly Milton's well-known passage relating to the invention of cannon as applicable to the invention of the telephone, and after eulogizing Prof. Bell very felicitously, spoke in warm praise also of the great work done by Mr. Emile Berliner in the matter of battery transmitters and the use of the induction coil. Mr. W. J. Sefton, of the Subway Board, then responded as to the underground wires of the past, and Commissioner Gibbens drew a glowing picture of the underground telephone work of the present, paying the telephone men a handsome and deserved compliment for the assistance they had rendered in such of the work as had fallen to the share of the New York subway board to do. Mr. R. W. Pope then spoke as an electrician who was a telegraph man among telegraphists, an electric light man with electric lighters, and a telephonist among such as he saw around him, and he remarked that it was a good sign to see the various electrical interests drawing closer together for mutual welfare and support. He made a strong appeal for good work and the use of the best material, and assured his hearers that with good service they could hold their own against all comers. Mr. Storke then replied briefly for the National Telephone Exchange Association as its treasurer. Mr. F. W. Jones, of the West Coast Telephone Company, spoke for South America, mentioning Mr. T. N. Vail, whose name several times during the evening elicited tremendous applause. Mr. De Groot, of Antwerp, spoke for the International Telephone Company, recommending greater and closer union among telephone men. Mr. W. A. Hovey replied gracefully, as an old journalist, for the press, and earnestly recommended that whenever his telephone friends saw misstatements about their business in the papers they should correct them. Otherwise they were themselves to blame, for any editor of a reputable paper was always willing to rectify a mistake or make proper explanations. Mr. Metzger than made a fitting acknowledgment in behalf of the gathering, of the splendid hospitality of the Western Electric Company, as well as of the earlier entertainment of the afternoon, and Mr. Brown replied for the company. He regretted the absence of his chief, Mr. Barton, now on his way home from Europe, and paid to Mr. Barton a tribute for manliness, integrity and ability that evidently had the full support and endorsement of the whole enthusiastic assemblage. The dinner was then closed by Mr. Hibbard, who started "Auld Lang Syne," in which all joined heartily, and then at midnight coach after coach rolled off through the green glooms of the Park, brimming over with humanity in its most festive and frolicsome mood. It was a royal evening all through.

On Thursday, at 10.30 A. M., about 250 guests of the Metropolitan Telegraph and Telephone Company embarked on board the steamer "Cygnus," of the Iron Steamboat line, at West Twenty-third street. The steamer then headed up stream, and the party were soon delighting themselves with the scenery of the Hudson River, as it unrolled in all its varied picturesqueness of woodland and meadow, busy towns and secluded mansions. An excellent band performed at frequent intervals. About 12.30 a very substantial collation was served on the saloon deck by Mazetti, and it was not the less enjoyed because the river air was fresh and cool. The boat went up as far as Croton Point, and then returned, making a stoppage at Twenty-third street about 4 P. M. for such as desired to go ashore. The number was, however, very few, and the boat then

made her way to Staten Island. After cruising down the bay, the steamer put in at the St. George's Casino wharf, and about 6.30 P. M. an excellent dinner was served in the Casino to about 250 gentlemen.

There was not much time after dinner for speechification. Mr. Theodore N. Vail was called upon with three cheers, but declined with smiles to do more than preside. Mr. Erastus Wiman made a neat speech, referring facetiously to the dinner as an evidence of the money to be made in telephony, and expressing his belief in a closer identity between the telegraph and the telephone. He was followed with brief remarks by Mr. A. B. Chandler, Gen. Barnum, Commissioner Gibbens and Commissioner Hess of the Subway Board. Mr. Charles A. Tinker, Mr. W. H. Eckert and others called upon limited their responses to bows and waves of the hand, and at 8.30 the party went to the grand stand, and obtained a vivid view of what would have been the value of telephone patents under a Nero who wanted everything for himself that could in any way be valuable to his subjects. This representation of the spectacular piece was greatly enjoyed, and thus a memorably pleasant day reached its close.

APPENDIX C.

OFFICERS FOR THE YEAR 1888–1889.

President.

HENRY METZGER, - - - - Pittsburgh, Pa.

Vice-President.

WM. D. SARGENT, - - - - Brooklyn, N. Y.

Secretary.

C. H. BARNEY, - - - - New York City.

Treasurer.

H. L. STORKE, - - - - New York City.

Advisory Committee.

For three years—MORRIS F. TYLER, New Haven, Conn.
For two years—EDWARD J. HALL, JR., New York City.
For one year—H. N. GIFFORD, Louisville, Ky.

Executive Committee.

HENRY METZGER, *Ex-officio*, - - Pittsburgh, Pa.
GEO. N. STONE, - - - - - Cincinnati, O.
SAMUEL M. BRYAN, - - - Washington, D. C.
J. W. DENVER, - - - - - Boston, Mass.
C. F. CUTLER, - - - - - New York City.

APPENDIX D.

ROLL OF ACTIVE MEMBERS,

SEPTEMBER 6, 1888.

American Telephone & Telegraph Co., New York City.
Bell Telephone Co.. of Buffalo, Buffalo, N. Y.
Bell Telephone Co., of Missouri, St. Louis, Mo.
Bell Telephone Co., of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Central Union Telephone Co., Chicago, Ills.
Chicago Telephone Co., Chicago, Ills.
City & Suburban Telegraph Association, Cincinnati, O.
Colorado Telephone Co., Denver, Col.
Chesapeake & Potomac Telephone Co., Washington, D. C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
Empire State Telephone & Telegraph Co., Auburn, N. Y.
Erie Telephone & Telegraph Co., Lowell, Mass.
Great Southern Telephone & Telegraph Co., New Orleans, La.
Hudson River Telephone Co., New York City.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City, Mo.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.
New York & New Jersey Telephone Co., Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York City.
New England Telephone & Telegraph Co., Boston, Mass.

Ohio Valley Telephone Co., Louisville, Ky.
Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburgh, Pa.
Rocky Mountain Bell Telephone Co., Salt Lake City, Utah.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven, Conn.
Sunset Telephone-Telegraph Co., San Francisco, Cal.
Wisconsin Telephone Co., Milwaukee, Wis.

ASSOCIATE MEMBERS.

American Electrical Works, Providence, R. I.
Hotchkiss, Clark B., New York City.
J. A. Roebling's Son's Co., New York City.
National Conduit Manufacturing Co., New York City.
Standard Electrical Works, Cincinnati, O.
Western Electric Co., Chicago, Ills.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Washington, D. C.
Bell Telephone Co., Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, George L., New York City.
Bailey, C. E., Havana, Cuba.
Berthon, A. F., Paris, France.
Callender Insulating and Water-proofing Co., New York City.
Childs, W. A., New York City.
Cheever, Charles A., New York City.
Cassidy, John, Honolulu.
Dana, R. K., New York City.
Day, A. G., New York City.
Electrical Supply Co., New York City.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington, D. C.

Madden, O. E., New York City.
Phillips, George L., Chicago, Ills.
Phillips, E. F., Providence, R. I.
Potter, F. I., Pittsfield, Mass.
Pope, H. W., New York City.
Sawyer, W. H., Providence, R. I.
See, I. W., Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., New York City.
Williams, Jr., Charles, Boston, Mass.
Wiley, George L., New York City.
Lemon, C., Wellington, New Zealand.

APPENDIX E.

CONSTITUTION.

ARTICLE I.—NAME.

The name of the Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual; but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, provided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of the Secretary and the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—Vice-President.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—Secretary.

The Secretary shall keep a record of the proceedings of all the meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—Treasurer.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—Executive Committee.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by the provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Secretary and transmit to the Association all applications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting. and the action of this Committee shall not be final, but advisvory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—Advisory Committee.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year: and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws, as in their opinion will best further the aims and purposes of the Association.

3. The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, affecting telephone interests, and shall report thereon to the Association with such recommendations as it may seem advisable.

4. It may also consider any questions touching the interests of the members of this Association that may be referred to it, and may call for papers or other

documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, as far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committee which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other persons, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. The Association at its annual meeting, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting.

2. Special meetings of the Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the constitution, and shall be payable yearly on or before the first day of October in each year for the year ending August 31st, thereafter.

2. The Association may, by resolution adopted by a majority of all the voters of the Association, make assessments on the members thereof, and such assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

ARTICLE XV.—Expulsion.

Any member may be suspended or expelled for misconduct, or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—Amendments

1. This Constitution shall go into effect immediately.

2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

3. Notice of such proposed change should be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post-office address of each member.

ARTICLE XVII.—Honorary Membership.

1. Any person nominated by the Executive Committee may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such elections to be by ballot.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

ARTICLE XVIII.—Associate Membership.

1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

2. An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments.

APPENDIX F.

BY-LAWS.

ARTICLE I.—Election of Officers.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—President.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—Secretary.

1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the object for which they are called; and shall keep correctly the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipts and disposal upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

5. Shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business, as have heretofore been furnished by the various committees of this Association.

ARTICLE IV.—Treasurer.

1. The Treasurer shall keep an accurate roll of the members, and shall collect, and under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

2. Shall keep regular books of accounts, which shall be opened to inspection by any member of the Executive Committee.

3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—Committees.

1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of the Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said committee, who will, in case it is not deemed expedient to hold a meeting of said committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report with the Secretary.

2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this Committee.

ARTICLE VI.—Membership.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of its Board of Directors, make application for membership, and shall forward a copy of such proceedings properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—Non-Payment of Dues.

If any member fails to pay the yearly dues or assessments within one month from the first day of October, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that

unless the same are paid within one month thereafter, the default will be reported to the Executive Committee; which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—Amendments.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting ; provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—Suspension of Rules.

These rules may be suspended at any meeting of the Association by a majority of all votes represented at such meeting.

ARTICLE X.—Statistical Committee.

At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be ex-officio chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require.

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ELEVENTH MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

ASSOCIATION,

HELD AT

The West Hotel, Minneapolis, Minn.,

September 10th and 11th, 1889.

1889.

"THIS ASSOCIATION DISCLAIMS RESPONSIBILITY FOR ANY PAPER READ AT ITS MEETINGS, UNLESS SO EXPRESSED BY A SPECIAL RESOLUTION."—*Resolution passed at the Minneapolis meeting of the National Telephone Exchange Association, September* 10, 1889.

PRESS OF
BROOKLYN EAGLE BOOK PRINTING DEP'T,
BROOKLYN, N. Y.

ELEVENTH MEETING

OF THE

National Telephone Exchange Association

HELD AT THE

WEST HOTEL, MINNEAPOLIS, MINN.,

SEPTEMBER 10th and 11th, 1880.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11:45 A. M., the President, Henry Metzger, of Pittsburgh, in the chair, and C. H. Barney, of New York, Secretary,

THE PRESIDENT—The first business before us is the calling of the roll. Members will please answer as the roll is called for the companies they represent.

THE SECRETARY—If in addition to answering to their names, the delegates will hand their cards to the Secretary, it will facilitate getting the roll in proper shape and having the names appear correctly in the printed proceedings. Mr. Albree has kindly offered to collect the cards as the names are called.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session.

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Edward J. Hall, Jr., Vice-President and General Manager; Melville Egleston, Secretary; Angus S. Hibbard, General Superintendent; Edward P. Meany, Superintendent Western Division

BELL TELEPHONE COMPANY OF BUFFALO, Buffalo, N. Y.—Edward J. Hall, Vice-President and General Manager; H. C. Palmer, Secretary and Treasurer; J. A. Culbertson, General Superintendent.

BELL TELEPHONE COMPANY OF MISSOURI, St. Louis, Mo.—A. O. Morgan, Director.

BELL TELEPHONE COMPANY OF PHILADELPHIA, Philadelphia, Penn.—Samuel M. Plush, General Manager.

CENTRAL DISTRICT AND PRINTING TELEGRAPH COMPANY, Pittsburgh, Penn.—Henry Metzger, General Manager.

CENTRAL NEW YORK TELEPHONE AND TELEGRAPH COMPANY, Utica, N. Y.—Henry L. Storke, Vice-President.

CENTRAL PENNSYLNANIA TELEPHONE AND SUPPLY COMPANY, Williamsport, Penn.—R. M. Bailey, General Manager.

CENTRAL UNION TELEPHONE COMPANY, Chicago, Ill.—Frank G. Beach, General Superintendent; J. E. Hockett, Superintendent.

CHICAGO TELEPHONE COMPANY, Chicago, Ill.—Charles H. Wilson, Superintendent.

CITY AND SUBURBAN TELEGRAPH ASSOCIATION, Cincinnati, O.—George N. Stone, Vice-President and General Manager.

CUMBERLAND TELEPHONE AND TELEGRAPH COMPANY, Nashville, Tenn.—J. M. Brown, Director.

DELAWARE AND ATLANTIC TELEPHONE AND TELEGRAPH COMPANY, Philadelphia, Penn.—W. T. Westbrook, Superintendent.

EMPIRE STATE TELEPHONE AXD TELEGRAPH COMPANY, Auburn, N. Y.—Henry L. Storke, President.

ERIE TELEPHONE AND TELEGRAPH COMPANY, Lowell, Mass.—Levi Sprague, President; Charles J. Glidden, Treasurer; J. P. McKinstry, General Manager; Abner S. Adams, Charles E. Adams, and J. A. Weston, Directors; C. P. Wainman, General Superintendent; Arthur C. Whidden, Cashier; G. W. Foster, District Superintendent; J. W. Christie and W. B. Joyce, Managers.

GREAT SOUTHERN TELEPHONE AND TELEGRAPH COMPANY, New Orleans, La.—A. W. Crandell, President.

HUDSON RIVER TELEPHONE COMPANY, New York City.—A. B. Uline, Vice-President and General Manager; Henry L. Storke, Treasurer.

METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Wm. H. Eckert, General Manager.

MICHIGAN TELEPHONE COMPANY, Detroit, Mich.—F. A. Forbes, General Superintendent; James R. Dee, Division Superintendent.

MISSOURI AND KANSAS TELEPHONE COMPANY, Kansas City, Mo.—W. W. Smith, Secretary; Charles W. McDaniel, Superintendent.

NEBRASKA TELEPHONE COMPANY, Omaha, Neb.—C. E. Yost, Vice-President and General Manager; L. H. Korty, Secretary; Flemon Drake, General Superintendent.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, Boston Mass.—J. N. Keller, General Manager; I. H. Farnham, Electrician.

NEW YORK AND NEW JERSEY TELEPHONE COMPANY, Brooklyn, N. Y.—Joel C. Clark, Secretary and Treasurer; W. D. Sargent, General Manager.

NEW YORK AND PENNSYLVANIA TELEPHONE COMPANY, New York City.—Joel C. Clark, Secretary and Treasurer; W. N. Eastabrook, General Manager.

OHIO VALLEY TELEPHONE COMPANY, Louisville, Ky.—H. N. Gifford, General Manager.

PENNSYLVANIA TELEPHONE COMPANY, Harrisburgh, Penn.—Josiah R. Davis, General Manager.

ROCKY MOUNTAIN BELL TELEPHONE COMPANY, Salt Lake City, Utah.—Geo. Y. Wallace, President; J. J. Dickey, Vice-President.

SOUTHERN BELL TELEPHONE AND TELEGRAPH COMPANY, New York City.—D. I. Carson, Secretary and General Superintendent; C. E. McCluer, First District Superintendent; J. D. Easterlin, Second District Superintendent; W. J. Cole, Third District Superintendent.

SOUTHERN MASSACHUSETTS TELEPHONE COMPANY, New Bedford, Mass.—Samuel Ivers, Treasurer.

SOUTHERN NEW ENGLAND TELEPHONE COMPANY, New Haven, Conn.—Morris F. Tyler, President.

WISCONSIN TELEPHONE COMPANY, Milwaukee, Wis.—F. E. Parker, Superintendent.

ASSOCIATE MEMBERS.

NATIONAL CONDUIT MANUFACTURING COMPANY, New York City.—James P. McQuaide, Treasurer.

STANDARD ELECTRICAL WORKS, Cincinnati, O.—E. V. Cherry, President.

WESTERN ELECTRIC COMPANY, Chicago, Ill.—J. M. Jackson, H. B. Thayer, W. R. Patterson, J. J. Carty.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE COMPANY, Boston, Mass.—A. O. Morgan, Thos. D. Lockwood, Thos. B. Doolittle, J. M. Brown, David B. Parker, Frank B. Knight, W. A. Hovey, H. S. Huidekoper, George Albree, George G. Hall, H. V. Hayes, Arthur G. Fuller.

BELL TELEPHONE COMPANY OF CANADA, Montreal, P. Q.—Charles F. Sise, President.

BRIDGEPORT BRASS COMPANY, Bridgeport, Conn.—Henry D. Stanley.

CHEEVER, CHARLES A., New York City, by George T. Manson.

CHILDS, W. A., New York City, by M. M. Hayden.

DAY, A. G., New York City, by C. E. McClees.

LOCKWOOD, THOMAS D., Boston, Mass.

WILEY, GEO. L., New York City, by Fred. E. Degenhardt and J. W. Marsh.

There were present at the meeting 30 active, 3 associate and 8 honorary members, represented by 79 delegates. 17 other persons interested in electrical matters, but not connected with the Association, were in attendance upon the open sessions of the same.*

THE PRESIDENT—The next order of business is the application of new members. Are there any applications, Mr. Secretary? and if so, please report them.

THE SECRETARY—Mr. President, I have received an application for associate membership from Messrs. Felton & Guilleaume, manufacturers of telegraph and telephone cables and wires, of Cologne, Germany. They are recommended by the Bell Telephone Company of Canada.

THE PRESIDENT—The application of Messrs. Felton & Guilleaume will be referred to the Executive Committee for investigation and report, under the rules of the Association, if there are no objections.

Are there any other applications?

THE SECRETARY—No, sir: there are no other applications.

THE PRESIDENT—The next business before the Association will be the reading of the Secretary's report.

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*The following institutions, individuals, newspapers and business concerns, not members of the Association, were also in attendance at the meeting, viz:

Baker & Co., Newark, N. J., by C. O. Baker, Jr.
"Electrical Age," New York City, by J. B. Taltavall.
"Electrical Review," New York City, by C. W. Price.
"Electrical World," New York City, by C. E. Stump.
Haines, H. M., Assistant Passenger Agent Pennsylvania Railroad.
Hair, R. S., General Eastern Agent, Chicago, St. Paul & Kansas City Railway.
Hope, Henry C., St. Paul, Minn., Railway Telegraph, Superintendent.
Johnson, C. F., New York City, Official Stenographer.
Knapp Electrical Works, Chicago, Ill., by M. A. Knapp and C. H. Cone.
Leonard, S. S., General Manager Brush Electric Light Co., Minneapolis, Minn.
McMichael, J., Superintendent Western Union Telegraph Co.
Mason, Frank C., Superintendent Police Telegraph, Brooklyn, N. Y.
Tuttle, H. A., Superintendent N. W. Telegraph Co. and Postal Telegraph Co.
"Western Electrician," Chicago, by W. A. Kriedler and J. W Dickinson.
Wabner, Gustav, Berlin, Sup't of Government Telephone system in that city.
All the Minneapolis daily papers were also represented.

The Secretary read his report, as follows;

SECRETARY'S REPORT.

NEW YORK CITY, September 1, 1889.

To the National Telephone Exchange Association:

GENTLEMEN—I have the honor respectfully to submit my report as Secretary of this Association, for the year terminating August 31, 1889.

The changes in membership since my last report have been as follows:

At the beginning of the Association year the roll of the Association showed 36 active, 5 associate and 29 honorary members. At the meeting in New York in September, 1888, the Cumberland Telephone and Telegraph Company and the East Tennessee Telephone Company were dropped from the roll of active membership by a vote of the Executive Committee, to whom their resignation had been referred by a vote of the Association. The Clark Insulated Wire Company having ceased to exist, was also dropped from the list of honorary members.

At the same meeting one new associate member was elected, viz: The National Conduit Manufacturing Company, of New York.

One of our esteemed honorary members has died since the last meeting, Mr. George L. Phillips, who was the first President of this Association, and has always been one of its most active and interested members. It is most fitting that this meeting, as it undoubtedly will do, should take appropriate notice of the loss which it has sustained by his decease.

These changes leave us, at the close of the year, a membership as follows: 34 active, 6 associate, and 28 honorary members.

There is now in the hands of the Secretary the resignation of the Sunset Telephone-Telegraph Company, of San Francisco, from the list of active members. The Company takes this step because it has virtually consolidated with the Pacific Bell Telephone Company, which is already a member.

Mr. Clark B. Hotchkiss, on account of ill health and virtual retirement from business, tenders his resignation as an associate member.

I respectfully recommend that both these resignations be accepted, and also that the name of the Callender Insulating and Waterproofing Company, which has failed and gone out of business, be dropped from the roll of honorary members.

One new application for associate membership is in the hands of the Secretary and will be presented in the proper order of business.

The office of the Secretary remained at No. 18 Cortlandt street until March 1st of the present year, when it was removed to No. 510 West Twenty third street, where it is now located.

There has been little change in the routine business of the office during the year. The NEWS LETTER has been issued twice each month, and the usual number of inquiries for information have been replied to, and the information furnished whenever practicable.

The Secretary takes this occasion to emphasize his repeated requests that the members of the Association will keep him promptly advised of any and all

matters of telephonic interest occurring in their respective localities. The furnishing of such information will greatly enhance the usefulness of the permanent headquarters of the Association.

The Secretary has had the pleasure of visiting the following exchanges during the year, viz: Boston, New York, Brooklyn, Philadelphia, Pittsburgh, Washington and Providence.

As will be seen by the report of the Treasurer, the expenses of the Association have been kept within its income, and the balance of cash on hand at the beginning of the year has been slightly increased, there being now in the treasury the sum of $66.41. All dues have been collected to date, and all bills paid, The Association neither owes anything, nor does anybody owe it anything.

The income of the year was derived from the following sources:

From annual dues	$2,000 00
" initiation fees	10 00
" sales of extra copies of proceedings	15 37
Total	$2,025 37

The distribution of the expenses is as follows:

For salary of Secretary	$1,200 00
" rent of office	75 00
" printing proceedings New York meeting	258 00
" other printing, *News Letter*, circulars and blanks	155 80
" office expenses, stationery, postage, telegrams, express and newspaper subscriptions	138 21
" Stenographer at New York meeting	95 00
" other expenses at New York meeting	58 60
Total	$1,980 81

It is reasonable to estimate that the income for the ensuing year will, as has been the case for several pears past, be just about sufficient to meet the current expenses.

Respectfully submitted,

C. H. BARNEY,
Secretary.

THE PRESIDENT—Gentlemen, you have heard the report of the Secretary. What is the pleasure of the Association?

MR. STORKE—I move the report be accepted and placed on file.

The motion was seconded, put, and carried.

THE PRESIDENT—Are the resignations of the Sunset

Telephone-Telegraph Company, of California, and Mr. Hotchkiss, associate member of the Association, here?

THE SECRETARY—I have them both.

THE PRESIDENT—The Secretary will now read these resignations.

The Secretary read as follows:

NEW YORK, September 27, 1888.

MR. C. H. BARNEY,

Secretary National Telephone Exchange Association, New York City:

Dear Sir—I herewith tender my resignation as a member of the Association, and desire that the same be accepted to take effect immediately.

Yours very truly,

CLARK B. HOTCHKISS.

September 25, 1888.

NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

H. L. STORKE, *Treasurer*, 18 Cortlandt street, New York:

Dear Sir—This Company respectfully withdraws as a member of the Association, for the reason that it is practically absorbed by the Pacific Bell Telephone Company, a member of the Association.

Yours truly,

J. I. SABIN,

General Manager.

THE PRESIDENT—You have heard the reading of the two letters. What is the pleasure of the Convention?

MR. SARGENT—I move that the resignations be accepted.

THE SECRETARY—The meeting of the Executive Committee recommended such action.

The motion was seconded, put, and carried.

THE PRESIDENT—Gentlemen of the Association, I have the honor of introducing to you Judge Atwater, of Minneapolis; he represents the city and also the Board of Trade, and who is here for the purpose of welcoming you to the city. [Applause.]

JUDGE ATWATER—Mr. President and gentlemen of The National Telephone Exchange Association: While the fame of your meeting here has gone before you, because it has been announced in our papers for two or three days, I had hoped that our worthy Mayor, even our Governor, perhaps, would have been here to represent our city on this

occasion. I learned since that some accident had detained our Mayor. For one, I believe that it is only simple courtesy, and I know it is the heartfelt feeling of all our citizens to give you a most cordial greeting to our city. [Applause.] Perhaps, gentlemen, I am hardly worthy to do it, and yet not entirely unworthy, I flatter myself. For, forty years ago in October coming, I landed on this bank of the Mississippi river—I should say the eastern bank, because at that time there was not a building on this side of the river. But I have been here all the time since more or less. Gentlemen, we feel honored that an association such as yours, that is known all over the United States, should have selected this city as the place for your deliberations on this occasion.

You do us honor, gentlemen, and we cannot give you too warm or too cordial an invitation here. Gentlemen, the great science, the great invention, the progress of the invention which you represent, now practically controls the world. No man doing business can live without the aid of that great invention which you represent. [Applause.] And I know you worthily represent it. I take it for granted that you are here to-day to consult on measures that will facilitate the business of every man in the United States. [Applause.] I presume you are here without any pecuniary interest in view. You are spending your time, your money and ability, all that you can give, to perfect that which we all depend upon in doing our business. We ought to feel honored when gentlemen of your, I may say, intense application, your little leisure for enjoyment, we ought to feel honored, when you come here to make the results of your labors more efficacious, better for the whole public, better for our own city.

Again, Mr. President and gentlemen of the Convention, on behalf of the Board of Trade of this city, on behalf of the Mayor, nay, I know I speak the sentiments of this city when I say, in behalf of all the citizens of this city, we bid you thrice welcome. [Prolonged applause.]

THE PRESIDENT—It gives me great pleasure on behalf of the members of this Association to return to you their

thanks for the very kind and cordial welcome that you have extended to them. Being here in the pursuit of a useful business, we have come to discuss matters pertaining thereto, and when we have discharged our duty, we no doubt shall leave your great, enterprising and beautiful city with pleasant recollections of our brief sojourn amongst you and of having visited your city which stands on the banks of that mighty river, of which it has been said by one of our greatest statesmen "that it rises where it never thaws, and flows where it never freezes." [Applause.]

Judge Atwater here retired amid great applause.

THE PRESIDENT—The next business in order is the report of the Treasurer.

THE TREASURER—I beg to present to the Association a detailed statement of the receipts and disbursements for the year, which agrees with the summary just presented by the Secretary. All the members of the Association from whom I should have collected dues have paid, and I have vouchers for all the disbursements, which I present with this report, and which in the regular order of business, as I understand it, will go to the Executive Committee. The balance is $66.41.

MR. TYLER—I move the report be referred to the Executive Committee.

THE PRESIDENT—The Executive Committee have examined the report.

MR. TYLER—I move it be accepted and placed on file.

The motion was seconded, put, and carried.

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

TREASURER'S STATEMENT FOR THE YEAR ENDING AUGUST 31, 1889.

RECEIPTS.

1888.			
Sept.	1	To balance	$21 85
"	22	" The Ohio Valley Telephone Co., Dues for 1889	50 00
"	22	" The Metropolitan Telephone and Telegraph Co., Dues for 1889	50 00
"	22	" Telephone and Telegraph Construction Co., Dues for 1889	50 00
"	22	" Bell Telephone Co, of Buffalo, Dues for 1889	50 00
"	22	" New England Telephone and Telegraph Co., Dues for 1889	50 00
"	22	" J. A. Roebling's Sons Co., Dues for 1889	50 00
"	22	" Central Union Telephone Co., Dues for 1889	50 00
"	22	" American Telephone and Telegraph Co., Dues for 1889	50 00
"	22	" Central District and Printing Co., Dues for 1889	50 00
"	22	" Delaware and Atlantic Telephone and Telegraph Co., Dues for 1889	50 00
"	22	" Chicago Telephone Co., Dues for 1889	50 00
"	22	" Hudson River Telephone Co., Dues for 1889	50 00

DISBURSEMENTS.

1888.					
Sept.	22	By Hoole Manufacturing Co., Voucher No.	214	$31 50	
"	22	" C. H. Barney..... " "	215	27 30	
"	25	" C. H. Barney..... " "	217	100 00	
"	27	" R. W. Ryan..... " "	216	95 00	
Oct.	6	" Jersey City Printing Co., " "	218	10 90	
"	6	" C. H. Barney..... " "	219	20 35	
"	6	" American Press Information Bureau..... " "	220	4 75	
"	31	" C. H. Barney..... " "	221	100 00	
Nov.	22	" The Electrical Review.... " "	222	3 00	
"	22	" Jersey City Printing Co. " "	223	10 75	
"	22	" American Press Information Bureau ..... " "	224	5 95	
"	22	" C. H. Barney..... " "	225	16 77	
"	22	" C. H. Barney.....Pt. " "	229	50 00	
"	28	" C. H. Barney..... " " "	229	50 00	
"	28	" C. H. Barney..... " "	230	23 29	
Dec.	13	" J. H. Cahill..... " "	231	2 00	
"	15	" C. H. Barney.....Pt. " "	232	50 00	
"	20	" C. H. Barney..... " " "		50 00	
"	20	" American Press Information Bureau ..... " "	226	4 80	

Sept.	22	To City and Suburban Telephone Association, Dues for 1889	50 00
"	24	" Chesapeake and Potomac Telephone Co., Dues for 1889	50 00
"	24	" Western Electric Co., Dues for 1889	50 00
"	27	" Standard Electrical Works, Dues for 1889	50 00
Oct.	3	" Pacific Bell Telephone Co., Dues for 1889	50 00
"	3	" Rocky Mountain Bell Telephone Co., Dues for 1889	50 00
"	3	" Bell Telephone Co., of Missouri, Dues for 1889	50 00
"	3	" Erie Telephone and Telegraph Co., Dues for 1889	50 00
"	5	" Colorado Telephone Co., Dues for 1889	50 00
"	9	" The Bell Telephone Co., of Philadelphia, Dues for 1889	50 00
"	11	" Providence Telephone Co., Dues for 1889	50 00
"	17	" New York and New Jersey Telephone Co., Dues for 1889	50 00
"	18	" Nebraska Telephone Co., Dues for 1889	50 00
"	20	" Wisconsin Telephone Co., Dues for 1889	50 00
Nov.	3	" Missouri and Kansas Telephone Co., Dues for 1889	50 00
"	12	" Central Pennsylvania Telephone and Supply Co., Dues for 1889	50 00
"	17	" American Electrical Works, Dues for 1889	50 00
"	27	" Southern Bell Telephone and Telegraph Co., Dues for 1889	50 00
		Carried forward	$1,521 85

Dec.	20	By Jersey City Printing Co.	Voucher No.	227		12 00
"	20	" Brooklyn Daily Eagle	" "	228		10 75
1889.						
Jan.	9	" C. H. Barney	" "	236		16 73
"	9	" C. H. Barney ...Pt.	" "	237		50 00
"	29	" American Press Information Bureau	" "	235		5 10
"	31	" C. H. Barney...Pt.	" "	237		50 00
Feb.	7	" C. H. Barney	" "	241		14 75
"	15	" John H. Cahill	" "	239		2 00
"	25	" C. H. Barney	" "	244		100 00
Mar.	27	" C. H. Barney	" "	245		16 02
"	27	" C. H. Barney	" "	247		100 00
April	23	" C. H. Barney	" "	252		100 00
"	23	" C. H. Barney	" "	238		
			242, 248 and	249		25 75
Aug.	29	" Jersey City Printing Co.	Voucher Nos.	234		
			240, 246, 250, 253, 254, 255, 260 263 and	264		120 65
"	29	" American Press Information Bureau	Voucher Nos.	251		
			256, 258, 261 and	266		24 10
"	29	" C. H. Barney	Voucher Nos.	257		
			259, 262, 265 and	267		414 10
"	29	" Brooklyn Daily Eagle	Voucher No.	233		258 00
"	29	" Broun, Green & Adams	" "	243		4 50
		Carried forward				$1,980 81

	Brought forward	$1,521 85
Nov. 28	To Pennsylvania Telephone Co., Dues for 1889	50 00
Dec. 3	" New York and Pennsylvania Telephone and Telegraph Co., Dues for 1889	50 00
" 6	" Bell Telephone Co., of Buffalo, Copies of Meeting	3 12
" 11	" American Bell Telephone Co., Copies of Meeting	5 25
" 11	" Bell Telephone Co., of Canada, Copies of Meeting	3 00
" 12	" Empire State Telephone and Telegraph Co., Dues for 1889	50 00
" 21	" Great Southern Telephone and Telegraph Co., Dues for 1887, 1888 and 1889	150 00
1889.		
Mar. 4	" Southern Bell Telephone Co., Copies of Meeting	3 00
Aug. 1	" The National Conduit Manufacturing Co., Initiation and Dues for 1889	60 00
" 12	" The Southern New England Telephone Co., Dues for 1889	50 00
" 13	" Central New York Telephone and Telegraph Co., Dues for 1889	50 00
" 22	" Southern Massachusetts Telephone Co., Dues for 1889	50 00
" 26	" W. H. Bush, Superintendent New York and New Jersey Telephone Co., Copies of Meeting	1 00
		$2,047 22

	Brought forward	$1,980 81
Aug. 31	By Balance	66 41
		$2,047 22

THE PRESIDENT—The next business before the Association is the reading of the minutes of the Executive Committee.

The Secretary here read the minutes, as follows:

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 5, 1888.

The Committee met at the Hotel Brunswick, New York City, at 3 P. M. Present, President Metzger, Messrs. Denver and Cutler.

It was voted to instruct the Secretary to drop from the rolls of the Association the names of the Cumberland Telephone and Telegraph Co., and the East Tennessee Telephone Co., those organizations having resigned, and that of the Clark Insulated Wire Co., it having ceased to exist. This action was taken by virtue of the power to act, voted to the Committee by the Association at the morning session of September 4th.

It was voted to reappoint C. H. Barney as Secretary, at the same salary as last year. It was voted to allow the Nebraska Telephone Company to circulate copies of T. D. Lockwood's paper read before the Association, in advance of the printed proceedings. The Committee then adjourned until Thursday, September 6, 1888.

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 6, 1888.

The Committee met on the steamer Cygnus, on the Hudson River, at 3 P. M. Present, President Metzger, Messrs. Bryan and Denver.

The Treasurer's report for the past year was audited and found correct.

It was voted to instruct the Secretary to furnish printed copies of the proceedings *to members of the Association only.*

There being no further business, the Committee adjourned.

C. H. BARNEY,
Secretary.

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 9, 1889.

The Committee met on the Special Telephone Limited Train *en route* to Minneapolis, at 8 P. M. Present, President Metzger, Messrs. Stone and Denver.

The Treasurer's report for the past year was audited and found correct.

It was voted to recommend to the Association the acceptance of the resignations of the Sunset Telephone and Telegraph Company, as an active, and of Mr. Clark B. Hotchkiss, as an associate member, and the dropping of the Callender Insulating and Waterproofing Company from the list of honorary members.

It was voted to recommend to the Association that the hours of meeting on Tuesday, 10th instant, be from 11 A. M. to 1 P. M., and from 3 to 5 P. M., and that the hours of meeting for Wednesday, 11th instant, be fixed hereafter according to circumstances.

There being no further business, the Committee adjourned.

C. H. BARNEY,
Secretary.

THE SECRETARY—The members will notice that there have been held three meetings of the Executive Committee since the last meeting of this Association.

THE PRESIDENT—You have heard the report, gentlemen: what is your pleasure?

MR. STORKE—I move that the report be received, and the recommendations contained therein be adopted.

The motion was seconded, put and carried.

THE PRESIDENT—I understand that there are some communications on the Secretary's table which it is proper to have read at this time

The Secretary read as follows:

August 15, 1889.

To the National Telephone Exchange Association:

GEN. C. H. BARNEY, *Secretary.*

Dear Sir—The Northwestern Telephone Exchange Company takes pleasure in extending to the members of the National Telephone Exchange Association and their ladies, an invitation to a carriage ride at Minneapolis, a visit to Minnehaha Falls, a carriage ride at St. Paul, and dinner at the Hotel Ryan, St. Paul, on Thursday, September 12, 1889.

Carriages will leave the West Hotel at 9:30 A. M.

LEVI SPRAGUE,
President.

THE PRESIDENT—You have heard the invitation, what is your pleasure?

Mr. LOCKWOOD—I move the hearty thanks of the Association be tendered to the Northwestern Telephone Exchange Company, and that the invitation be referred to the Executive Committee to reply.

The motion was seconded, put, and carried.

THE SECRETARY—In case of the acceptance of the invitation, I was requested to make the following announcement:

The entertainment to be provided by the Northwestern Telephone Exchange Company will terminate in season for all delegates to take the evening train out of St. Paul on Thursday, if they so desire. All trunks will be transferred Thursday morning to the Union Station at St. Paul, and they can be checked by their owners from there to their destination. Small hand baggage will be transferred to the reception room of the Ryan Hotel, St. Paul, where it can be had at any time after the party arrives. All baggage must be ready by 8:30 A. M., Thursday morning, and delegates desiring to have their baggage taken care of in the above manner will please hand their names, and number of their rooms to Mr. C. J. Glidden, Treasurer of the Northwestern Telephone Exchange Company, by Wednesday noon. Those that will accept the invitation of the Northwestern Company will please notify Mr. Glidden before the close of the session this afternoon, that tickets may be furnished them and all arrangements completed.

It is hoped that all the ladies and gentlemen will accept the invitation.

MR. STONE—Mr. President, we did not all quite understand Mr. Lockwood's motion. Will he please state it again?

MR. LOCKWOOD repeated the motion.

MR. STONE—Would it not be as well to take the matter up and act upon it at once.

MR. LOCKWOOD—I thought it was possible that there might be other information from that Company. I have no objection whatever to what you propose.

MR. STONE—I move, Mr. President, that we reconsider our former action, and that the invitation be accepted, with thanks.

The motion was seconded, put, and carried.

THE SECRETARY—There is one other letter, Mr. President, as follows:

MINNEAPOLIS, Minn., September 10, 1889.

To the Members of the National Telephone Exchange Association:

Gentlemen—A cordial invitation is extended to you all to visit our Electric Light Station, foot of Third avenue, North,—Office, No. 11 Washington avenue, North.

MINNESOTA BRUSH ELECTRIC CO.,
By S. S. LEONARD,
General Manager.

THE PRESIDENT—You have heard the invitation, gentlemen. What is your pleasure?

MR. STORKE—I move the invitation be accepted, with thanks.

The motion was seconded, put, and carried.

THE PRESIDENT—The next business before the Association is the election of officers to serve for the ensuing year. The officers to be elected are the President, Vice-President, Treasurer, Executive Committee, and one member of the Board of Advisory Committee. Nominations are now in order.

MR. GLIDDEN—I take pleasure in nominating Mr. W. D. Sargent, of Brooklyn.

The nomination was seconded.

THE PRESIDENT—Are there any other nominations? If not, the nominations will close.

MR. STORKE—I move you, Mr. President, that the Secretary of the Association deposit the ballot of the Association for Mr. W. D. Sargent as our President.

The motion was seconded, put, and carried.

The Secretary cast the ballot and the President announced Mr. W. D. Sargent as President. Mr. Sargent was called to the chair, and the President said: "Gentlemen, I have the honor of presenting to you Mr. W. D. Sargent, one well known to all of you, and a gentleman who is as modest as he is able. [Great applause.] I will invest you, Mr. Sargent, with the badge of your office."

MR. METZGER here pinned the badge bearing the word "President," upon Mr. Sargent's breast, and retired from the chair, which was assumed by the newly-elected President.

THE PRESIDENT—You all know I have no gift of language whatever; therefore, gentlemen, I do not feel that I can make a speech that would be fitting, and that would express the high appreciation I feel of the honor you have seen fit to confer upon me. I regret it very much on your account, because I think you would like to listen to a nice speech. But I have endeavored in my connection with the Association in the past to be a worker and not a talker. I trust, of course, that remark will not be misconstrued. Thanking you for the honor, gentlemen, we will proceed to business. [Applause.]

THE PRESIDENT—The next business in order, gentlemen, is the nomination for Vice-President.

MR. STONE—I desire to place in nomination for Vice-President one of the old standard bearers, a gentleman so well known by every member that he needs no recommendation. I name for Vice-President of this Association Mr. F. G. Beach. [Applause.]

THE PRESIDENT—Are there any other nominations ?

MR. ULINE—I move the Secretary be instructed to cast one ballot for Mr. Beach as Vice-President.

The motion was seconded, put, and carried.

The Secretary here cast the ballot, amid applause and numerous calls for Mr. Beach.

MR. Beach came to the platform, amid applause, and said : " Gentlemen, I am no speech-maker, but thank you for the compliment."

THE PRESIDENT—The next business in order is the election of the Treasurer.

Mr. H. L. Storke was nominated all over the room.

MR. EASTABROOK—There seems to be no other name, and I ask unanimous consent that the Secretary be allowed to cast the ballot for Mr. Storke as the Treasurer for the ensuing year.

The question was seconded, put, and carried.

MR. Storke was loudly called for.

MR. STORKE—I thank you, gentlemen, for this compliment to a tried and faithful officer. [Laughter.] It is an

old saying, and one in which we all believe, that "money talks." If it is true, $66.41 cannot have much to say. [Applause and laughter.]

THE PRESIDENT—The next business, gentlemen, is the election of an Executive Committee, of which there are four members. The retiring members are: Geo. N. Stone, Cincinnati, Ohio; Samuel M. Bryan, Washington, D. C.; W. J. Denver, Boston, Mass.; C. F. Cutler, New York city.

THE TREASURER—I would nominate Mr. Cutler to be his own successor.

MR. METZGER—I would nominate Mr. George N. Stone, of Cincinnati.

MR. STONE—I thank the gentleman very kindly for nominating me; but I have been twice thus honored.

THE PRESIDENT—I would like to ask the Association whether it is their desire to vote for these gentlemen singly or not. If so, we want to vote on the nomination of Mr. Cutler first.

MR. STONE—I second the nomination of Mr. Cutler.

The question was put and Mr. Cutler was elected.

MR. DRAKE—I take pleasure in presenting the name of Mr. Charles H. Wilson, of Chicago. (Seconded by Mr. Stone.)

The question was put and Mr. Wilson was elected.

MR. METZGER—I would like to renew my motion for the nomination of Mr. Stone, of Cincinnati. We all recognize the ability of Mr. Stone, and it seems to me that the Association will be most worthily represented. I hope he will reconsider his determination not to accept the position, provided the Association tenders it to him. I move his nomination.

MR. STONE—I had in mind a very handsome little speech which I was about to make when the interruption occurred, and it has made me forget it. I feel I have been sufficiently honored by this Convention, having been twice elected on the Executive Committee. There are other members that ought to participate in these honors, and I desire to withdraw in favor of Mr. Gifford, of Louisville. I think that

will meet with the approval of the members of the Association.

MR. METZGER—In view of what Mr. Stone has said, with the consent of my second, I will withdraw the nomination of Mr. Stone.

The nomination was withdrawn and the question put on the nomination of Mr. Gifford, and declared carried.

THE PRESIDENT—Nominations are now in order for the fourth member of the committee.

MR. STONE—I desire to nominate as the fourth member Mr. Levi Sprague, of Lowell, Mass.; I think it is proper that the large company he represents should have a representation, and it is due them that we extend the honor by electing one of their number on the Executive Committee.

The motion was seconded, put, and carried.

THE PRESIDENT—In place of Mr. Gifford of the Advisory Committee, whose term expires this year, a nomination will be in order.

MR. GIFFORD—Who are the remaining members?

THE PRESIDENT—Mr. E. J. Hall, Jr., and Mr. M. F. Tyler.

MR. GIFFORD—Those are both good men.

THE PRESIDENT—Are there any nominations for this committee?

MR. GIFFORD—I nominate Mr. Geo. N. Stone. I was sorry he declined the other nomination, and that they put me on the Executive Committee. With Mr. Stone, Mr. Hall and Mr. Tyler, I do not think we could have a better Advisory Committee. I would be glad to see him there.

The question was here seconded, put, and carried.

MR. TYLER—Mr. President, does that complete the organization?

THE PRESIDENT—I believe that it does. The Convention is now open for business.

MR. TYLER—Before we proceed to our regular business, the topics, etc., and the discussion of them—which really is the cause of our coming here—I wish to refer to a passage in the Secretary's report, and to suggest action thereon. I

refer to the death of Mr. Phillips. It has been our fortune in the history of this Association (or rather, I should say, our *mis*fortune,) to lose two of our presidents—the two earliest ones. But I think that nothing could have occurred in the history of the telephone business that could come more closely home to each individual who has been connected with our association work than the death of Mr. Phillips. I cannot stand here, sir, and talk about it for any length of time. He was my personal friend, as I believe he was the personal friend of every man in the business, who knew him, and to think that, with that splendid physique, with that splendid energy, with his heart in the business, and with the brain he had to give to it, with the opportunities he had for its improvement and development, that this should all have been cut off thus suddenly, and it seems to us mortals so needlessly, it is something I cannot talk about. But I think, sir, it is no more than fitting that the Association should put upon record their expression of what he was to the business, and also express their regret. I beg to offer some resolutions which I have been asked to draw up. I feel, sir, that they are not what they should be, and shall be only too pleased to receive some suggestions or amendments. In fact, I rather think they should be referred to a committee for review. But they are as they are, and as they came to my mind this morning.

WHEREAS, Since the last meeting of this Association we have lost by death our ex-President, Geo. L. Phillips.

Resolved, That this Association regards the death of Mr. Phillips as at once a most serious loss to the business in which we are all engaged, and a great bereavement to this body. Prominent as he was in its organization, efficient and capable as its first President, active and sagacious in its subsequent deliberations, he, more than any other man, stood for and represented this Association. In his connection with the general business, only those directly associated with him can fully appreciate his unflagging energy, tact, foresight and devotion to its advancement. His heart as well as his brain were in it.

Resolved, That this Association farther takes this opportunity of recording its esteem and affection for Mr. Phillips as a man. He will be missed as a personal friend by all its members, and his death has been felt by each to be a private grief. The Association feels that it can no better express its feelings at his death than by the simple words, " we loved him."

Resolved, That the Secretary convey to Mr. Phillips' family the expression of our deep sympathy with them in their loss. together with a copy of these resolutions.

MR. METZGER—I think that Mr. Tyler has in fitting terms expressed the feelings of regret which we all experienced at the death of this member of our Association, who stood so close to us, Geo. L. Phillips, the first President of this Association. And I therefore move that these resolutions be engrossed upon the minutes of the Association, and that they be adopted as the sense of the Convention.

MR. LOCKWOOD—Mr. Chairman, I will take upon myself to say one word on the part of the honorary members of this Association. I have known Mr. Phillips as a telephone man perhaps as long as any one here, and in common with the rest of you, it did not take me long to appreciate the sterling virtues of the man, as well as the sterling ability he displayed in the telephone business. I feel that I, for one, experienced a personal as well as an association loss. Although, as I have said, I knew Mr. Phillips early and loved him, it was not until within the last few years that I became intimately associated with him—not until he took active charge of the Chicago Telephone Company. I recollect, with pain, the impression that prevailed all around the office of the American Bell Telephone Company, when we heard of his sickness, and of the little chance that he had for recovery, and while we hoped against hope, there was a kind of foreboding feeling from the first that it was against hope. I join most heartily in the sentiments expressed in those resolutions, and I second the motion. I feel with Mr. Metzger that the resolutions well express the feeling of the Association, and that while it might be possible to record our thoughts in more eloquent language, yet should we attempt to do so, I feel as if the resolutions would lose much of the spontaneity which they now possess. I therefore second the motion.

MR. CARSON—As one of the members of our first convention at Niagara Falls, where I first met Mr. Phillips, and where he made an impression upon me which I never can

forget, I desire to add just a word of concurrence with the expressions in the resolutions presented by Mr. Tyler. I did not know Mr. Phillips, intimately and personally, and therefore it seems to me that the impression that I can express, more fully demonstrates the personality and power of the man, making himself felt upon all his associates. He was so cordial; he had such a big heart that one could not have any association with him without feeling impressed by more than ordinary impressions. I desire, therefore, to add a second to the motion for the adoption of the resolutions. And I would like, sir, to move further, or as an amendment, that the action on them be taken by a rising vote.

MR. J. M. JACKSON--I am not perfectly familiar with the rules of this Association, but I have an impression that associate members are not entitled to the floor, and yet I trust that I may be pardoned by this Association if I ask that privilege for just one moment, because Mr. Phillips was one of the most valued and one of the oldest directors of our company, and a man whom we not only respected for his eminent business ability, but to whom, personally, we were devotedly attached. And I recollect well, when I lay very sick myself last January, and the news of his severe illness came to me, how like a great burden it was. I recollect the keen pain that came to me when I heard he had passed away. I want to say that Mr. Phillips was not only a man who understood his duties to the stockholders and had the ability to perform them, and who understood his duties to the public and had the ability to perform them also, but a man who understood his duties to the employees under him and knew how to perform them. It was only last Sunday evening that I was speaking to a lady of prominence in Chicago, prominent socially, and in every good work, and she was telling me how Mr. Phillips came to her at the time of the fitting up of the new building of the Chicago Telephone Company, and requested that she, and one or two other ladies, would help him with their advice as to just how to make the quarters there the most comfortable for the young lady employees, and spoke of his plans for their comfort and welfare and

advancement. As we spoke of that incident in his life, we felt we were spending our Sunday evening most appropriately. Mr. President, I desire to second these resolutions.

MR. CHERRY—I wish to say one word, as one of the old pioneer members, the few that are left among us here, who elected him as the first President. I, as well as Mr. Tyler. feel the loss personally, as I know we all feel, and I simply want to add this word to his memory.

MR. W. W. SMITH—I, too, am unwilling to let this hour pass without a word as to Mr. Phillips' memory. I have known him long and well. I knew him before the days of the telephone business. When we heard of his death, we felt that a great light had gone out, and even now, feel that the gloom is still upon us. I most heartily add my second to the resolutions.

THE PRESIDENT—Gentlemen, you have heard the resolutions offered by Mr. Tyler. I wish to state that I, too, made Mr. Phillips' acquaintance at the first meeting of this Association, and became, as we all did, a warm personal friend of his. I think on occasions like this, that the words spoken cannot convey our appreciation as fitly as they should; but we can at least express it as best we may, and I, therefore, take pleasure in putting the question. Also, as a fitting tribute to the memory of Mr. Phillips, I think that the suggestion of Mr. Carson that the vote be taken standing is a very good one. All, therefore, in favor of the adoption of these resolutions will express the same by rising.

The resolutions were unanimously adopted, every delegate rising to his feet.

THE PRESIDENT—Gentlemen, the Secretary will read one or two letters, which will be of interest to the Associa tion.

THE SECRETARY—The first thing I have to present, Mr. President, is another application for membership, or rather, an application for reinstatement, which has been received since that order of business was disposed of.

The Secretary read as follows:

"MINNEAPOLIS, Sept. 10, 1889.

"GEN. C. H. BARNEY,

"*Secretary* NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

"Minneapolis, Minn.

"*Dear Sir*—I am requested by President Duncan, of the Cumberland Telephone Company, to make the application of the Cumberland Telephone and Telegraph Company for reinstatement to membership of the National Telephone Exchange Association.

"Yours truly,

"J. M. BROWN,

"*One of the Board of Directors of the Cumberland Telephone Company.*"

MR. STONE—I move that that application be referred to the Executive Committee. I believe that is the proper reference.

The motion was seconded, put, and carried.

THE SECRETARY—I have a letter here from Messrs. Chas. A. Pillsbury & Co., Minneapolis, Minn.

The Secretary read as follows:

"MINNEAPOLIS, MINN., Sept. 10, 1889.

"MR. A. C. WHIDDEN,

"*Cashier* N. W. TELEPHONE EXCHANGE CO., City.

"*Dear Sir*—We take pleasure in extending to the members of the Convention of Telephone Managers the hospitalities of our Mill 'A.' We shall be pleased to meet them there at any hour they may designate.

"Very truly yours,

"CHAS. A. PILLSBURY & CO."

THE PRESIDENT—What is your pleasure, gentlemen, with this invitation?

MR. METZGER—I move the invitation be accepted, with the thanks of the Association, and referred to the Executive Committee to arrange the details.

The question was seconded, put, and carried.

THE SECRETARY—There is a telegram from Mr. Dusenbark, the manager of the railroad by which we came from Chicago.

The Secretary read as follows:

"CHICAGO, Sept. 10, 1889.

"GENERAL C. H. BARNEY,

"NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

"Care of R. S. HAIR, West Hotel.

"*Dear Sir*—I am in receipt of the following telegram: 'The freedom of

the Minnesota State Agricultural Society is hereby cordially extended to yourself and the entire delegation for Tuesday, September the 10th.

"'WILLIAM M. BUSHNELL,

"'*President.*'

"I have telegraphed President Bushnell your address, and you may hear from him direct.

"Yours very truly,

"W. R. DUSENBARK."

THE PRESIDENT—What is your pleasure, gentlemen, as to this invitation on the part of the Minnesota State Agricultural Society?

MR. GIFFORD—I move it be accepted, with the thanks of this Association for the courtesy extended. I will correct, however, and move that we accept with our thanks, and refer to the Executive Committee for the arrangement of the details.

The motion was seconded, put, and carried.

THE PRESIDENT—Is there any other business before the Association?

THE SECRETARY—There is nothing at this time.

THE PRESIDENT—There being no immediate further business, and the hour having arrived for a recess, a motion that we adjourn will be in order.

MR. TYLER—May I ask if there is a programme arranged for this afternoon.

THE PRESIDENT—On the reassembling of the Association, after dinner, the Executive Committee will be prepared to report on the papers offered. I will declare the Association adjourned till 3 o'clock this afternoon.

AFTERNOON SESSION.

The Convention was called to order by the President, at 3 P. M.

MR. LOCKWOOD—Mr. Chairman, before proceeding with the business of the Association, I would present to you and to the Association, Mr. Gustav Wabner, the gentleman in charge of the Telegraphic and Telephone Departments in the city of Berlin. This gentleman has heretofore been in

various countries and has experienced courtesies from telephonic and telegraphic officials of the various companies and governmental organizations, and we all know how pleasant it is to be cordially met in foreign lands. I have been requested by several gentlemen connected with the Association to ask, on behalf of Mr. Wabner, that he be allowed to participate in the privileges of the Convention during the meetings of this Association, and, Mr. Chairman, if any motion is necessary to legalize these privileges, I hereby make the motion that these privileges be extended to Mr. Wabner.

THE PRESIDENT—I think that all the members will join with Mr. Lockwood and myself in extending a very hearty welcome to Mr. Wabner as a representative of the German telephone system, and it does not seem to me that any motion is necessary in this Association, except to extend to him the privileges of the floor during this meeting. I think that the members of the Association will unanimously agree to give Mr. Wabner these privileges. If there is no objection, we will consider that that is settled.

The Secretary has several communications that he wishes to read.

THE SECRETARY—The first communication was received about five minutes after our recess at 1 P. M., and is from Mr. Tuttle, the General Superintendent of the North American Telegraph Company, which has an office in this hotel:

"The use of the Postal and our lines is respectfully tendered to the members of your Convention for all personal messages.

"Yours,

"H. E. TUTTLE,

General Superintendent."

I would say that the young lady in charge of the office has been instructed to allow the use of the lines, free to any member of the Convention for the sending of personal messages, upon exhibiting the button badge of the Association.

MR. EASTABROOK—I move that the Convention extend a vote of thanks to the North American Telegraph Company.

This motion was seconded and carried.

THE SECRETARY—The other communication is a telegram which supplements the informal one of this morning, and is an official invitation from the management of the State Fair Grounds.

"MR. C. H. BARNEY,

"*Secretary* NATIONAL TELEPHONE EXCHANGE ASSOCIATION,

"West Hotel.

"We extend a cordial invitation to your body to visit our State Fair to-morrow, arriving here at 1 P. M., if agreeable to you. Answer quick.

"WM. BUSHNELL,

"*President.*"

THE PRESIDENT—Gentlemen, what is your pleasure with this invitation?

MR. GIFFORD—Mr. Chairman, I understand we are invited to ride to-morrow.

THE SECRETARY—No; on Thursday.

MR. GIFFORD—This invitation is for 1 o'clock, and the fair is ten miles from here. I just want to state one or two facts which occur to me, and the Convention can do as they please. This is an invitation from a State organization—an organization representing the brawn and muscle of the agricultural interests of this State, and it is worthy of our consideration. It is from men all over the State—representative men—and if it is possible for us to arrange to attend, we should accept the invitation. I do not know what the programme is; but we ought to treat the invitation with all possible courtesy, even if we cannot accept it.

MR. HIBBARD—I move that the invitation be referred to the Executive Committee.

THE PRESIDENT—The Chair would state that the Executive Committee has already considered this invitation, and we think it is quite an honor to receive such an invitation from such a representative body of citizens of this State, and that we should, if possible, accept that invitation, even if it became necessary to disarrange our plans as already formed, which are to have a session to-morrow afternoon. It would seem to me that this is the best action to take, if we could accept the invitation for to-morrow afternoon, and

then arrange for another session at night, or else we will have to extend the time to get through with the papers.

MR. GLIDDEN—The members can leave at half-past twelve from the Union Station, Minneapolis, and take a train direct to the fair, arriving in fifteen minutes.

THE PRESIDENT—I think the members of the Association would be honoring themselves, as well as honoring this Association, by accepting that invitation, and going there in a body. If the Association chooses to take such action as is necessary to carry out that plan, I shall be very glad to put the question.

MR. E. J. HALL, JR—I understood that communication was referred to the Executive Committee to carry out the details.

THE PRESIDENT—That was the invitation which was received this morning, which was for to-day, and practically came too late. This is a second invitation received while the Executive Committee was in session, and makes the invitation for one o'clock *to-morrow*, instead of for to-day.

MR. E. J. HALL, JR—I move that the invitation be accepted.

MR. GIFFORD—We ought to arrange to accept this invitation and to go, even if we allow some other things to go by. We either want to decline it on account of previous arrangements, or else go in a respectable body so as to do ourselves credit and satisfy them.

THE PRESIDENT—I think, as I said before, that we will honor ourselves, as I have no doubt they would consider that we will be honoring them, by going as a representative body of telephone men, and the motion has been made, as I understand it, that we accept the invitation and proceed in a body to-morrow afternoon, the details of the arrangements to be perfected by the Executive Committee. Is the motion seconded?

This motion was duly seconded, put, and carried.

THE PRESIDENT—The next business, it seems to me, would be to provide for another session, because if we lose the session to-morrow afternoon it is going to cut short our time,

and I imagine that many of the members have calculated to get away on Thursday night; therefore, the Association should take such further action as they may think best.

MR. E. J. HALL, JR—I intended in that resolution to cover all the arrangements that might be required, not only the arrangements for attending this fair, but also providing such re-arrangements of other plans as might be necessary.

THE PRESIDENT—If there is no objection on the part of the Association the resolution will be considered as passed in accordance with the remarks just made by Mr. Hall, which will, of course, cover the whole question.

What is the next business?

THE SECRETARY—The Executive Committee have acted upon two applications for membership; that of Messrs Felton and Guillame, manufacturers of telegraph and telephone cables and wires, Cologne, Germany, who apply for associate membership, and that of the Cumberland Telephone and Telegraph Company, who apply for active membership. The Executive Committee appprove both applications and recommend their admission.

MR. EASTABROOK—I move that the action of the Executive Committee be confirmed.

THE PRESIDENT—The confirmation of the Executive Committee's report hardly carries with it the election of those members. It seems to me there should be a resolution electing those members; some member should offer a resolution to that effect, and let the Association vote upon it. That is the customary way of electing members.

MR. EASTABROOK—I make this motion:

Resolved, That the report of the Executive Committee be placed on file and the applicants for membership be elected to the Association according to their respective applications.

The motion was seconded, put, and carried.

THE PRESIDENT—The Executive Committee exercises a sort of censorship over the papers offered to this Association, and the members of the committee are quite in harmony in feeling that it would be better for the Association

to go at once into executive session on the subject of the papers that are offered at this meeting, and if a motion is put to that effect——

MR. METZGER—I do not quite understand the Chair.

THE PRESIDENT—The Executive Committee recommends that the Association go into executive session.

MR. METZGER—I make the motion that this Association go into executive session.

This motion was seconded by Mr. Lockwood, put, and carried.

THE PRESIDENT—The meeting will now open in executive session.

(SECRETARY'S NOTE.—As will be seen by a perusal of the following minutes, the Association voted that all the papers read before it be printed in the proceedings, also such portions of the discussions thereon as the Executive Committee should deem best, and the succeeding portions of this report are published in accordance with this authority.)

THE PRESIDENT—I think the Association will agree to admit the representatives of the American Bell Telephone Company, and also, the gentleman from Germany, to the executive session. If there is no objection to including those gentlemen, they may remain.

MR. STORKE—I move, Mr. Chairman, that all associate and honorary members be allowed the privileges of the executive session; and until further ordered, all honorary and associate members be allowed to participate in the executive meetings.

This motion was seconded by Mr. Smith.

MR. CRANDELL—I offer an amendment that all persons not regular members of this Association, except the American Bell Telephone Company, and the gentleman from Germany, be excluded from the executive session.

The amendment was seconded.

THE PRESIDENT—This excludes all outside of the active members, except the American Bell Telephone Company and the gentleman from Germany.

The President then called for a rising vote, and fifteen were counted in favor of the amendment, and nine against it.

The amendment was declared carried.

The question was then put on Mr. Storke's original motion, and it was lost, 15 to 10.

MR. TYLER—Mr. President, I move that this Association invite to sit with it, in executive session, any honorary or associate members who may be present.

The motion was seconded.

THE PRESIDENT—The Chair is quite in accord with Mr. Tyler in that respect.

The question was then put and carried.

THE PRESIDENT—(In reply to a question by Mr. Lockwood.) The Chair is very clear that the resolution which was passed admits all honorary and associate members present to the floor. There is no doubt about that. The Association is now in executive session, and the object of the executive session is to consider the papers that have been offered to be read at this meeting, and if there is no objection on the part of the members, these papers will be read by their titles by the Secretary. I think the most of them have been read by enough of the members to give their purport. Then, it seems to me, you want to decide whether you will read them in executive session or not, and if there is no objection the business will take that course. The Secretary will read the titles of the papers that are offered.

THE SECRETARY—The first paper on the list is entitled "The New Era in Telephony," by Messrs. A. S. Hibbard, F. A. Pickernell and J. J. Carty; then "Underground Construction in Brooklyn," by Mr. J. C. Reilly, Superintendent of The New York and New Jersey Telephone Company; a paper on "Switchboards and Long Distance Lines on Grounded Circuits," by Mr. Flemon Drake, of The Nebraska Telephone Company; "Interferences with the Alternating Electric Light Current," by Mr. E. H. McFall, electrician of The Great Southern Telephone Company, New Orleans, La.; "Telephone Salutations," by Mr. Bailey, of The Central Pennsylvania Telephone and Supply Company; "Statistical Report of the Year," by the Secretary; a paper on "Multiple Switchboards," and also some observations upon experiences abroad, by Mr. W. D. Sargent, President of the Asso-

ciation, and a paper entitled "The Progress of Telephony in Great Britain," by Mr. T. D. Lockwood.

MR. STORKE—I move that the Association now proceed to hear the papers submitted by the Executive Committee in the order named by the Secretary.

The motion was seconded, put, and carried.

THE PRESIDENT—Gentlemen, Mr. Carty will read the first paper on the list, which is entitled "The New Era in Telephony."

Mr. Carty then read the following paper:

THE NEW ERA IN TELEPHONY.

BY A. S. HIBBARD, J. J. CARTY AND F. A. PICKERNELL.

During the past three or four years much has been written and said about long distance telephoning and the work of the American Telephone and Telegraph Company of New York. It has been announced that in the experiments carried on by this company, a perfect telephone service has been accomplished either for long or short distances. As the extension of the so-called "long distance" lines has progressed it has been shown in many of the eastern cities that these results are accomplished, not only experimentally but practically, and so reliable and perfect is this telephone service, even at very long distances, that it has become an integral factor in the most important departments of trade and commerce, and as much to be depended upon as mail or railway service.

The steady and gratifying increase in business over the "Long Distance" lines has shown that the public will appreciate good and satisfactory telephone service when it is provided, and the demand for this perfected service may be said to have created a new era in telephony.

While some improvements in apparatus have been incident to the new service, the principal factor has been the proper use of metallic circuits in telephone work. By means of metallic circuits properly arranged, all inductive interference from adjacent lines of telephone, telegraph, electric light or power wires, as well as disturbances from atmospheric or earth currents, have been overcome. Circuits have been successfully operated through longer lengths of submarine or underground cables than has heretofore been practicable, and late conferences have provided a standard specification for cable manufacturers. Metallic circuit switchboards have been provided, even in large exchanges with the multiple system, and the long distance cabinet instrument has been applied for the convenience of the subscriber. Thus there has been supplied what would seem to constitute all the necessary provisions for the new service. Those component parts, however, although essential to it, will not, in themselves, accomplish the desired result.

It has been the experience of the American Telephone and Telegraph Company that grounded circuit methods, as they have been generally practiced in telephony, are not satisfactory when applied to metallic circuits. Many radical

changes have been made. The great underlying principle has been found to be that a perfect balance of the two sides of the circuit throughout its entire length is necessary to the best results, and to maintain and preserve this balance requires the closest attention to every detail. In other words, the new service requires, first, proper engineering, second, a force educated and trained to carry out the plans provided.

As representative of the practices in vogue at the present date, we give in detail the specifications of a local metallic circuit and its usual extensions.

At the subscriber's station should be placed a long distance cabinet set. This is in the form of a small desk, and is supplied with the usual working parts of a magneto bell, wired with waterproof insulated wire on a grooved base board, so laid out that no two wires cross each other at any point. The telephone hook is provided with platinum contact points. The binding posts are of the double lock nut style, and provide a large bearing surface for the attached wires. The line wires are led to fusible coil arresters, which burn out with a circuit of one-half an ampere, combined with two plate arresters, having an area of about one-half a square inch and insulated from the ground plate by a strip of mica. Underneath the desk a battery box is provided which is capable of holding three 6x8 jars. A push button is placed conveniently, by means of which the subscriber is enabled to cut out the secondary coil of the transmitter, thus lessening the retardation in the circuit, and at the same time removing the microphonic disturbances caused by his own transmitter.

There should be used on this cabinet set generally three cells of open circuit battery. The internal resistance of each cell or battery should not exceed one half an ohm, and the electromotive force should not decrease over 15 per cent. after the three cells of battery connected in series are short-circuited through a resistance of seven ohms for twenty minutes. In cases where the transmitter is to be used for longer periods, it is necessary to use a constant current battery. We find the Fuller battery to give the best results under such conditions.

For the interior office wire nothing less than copper wire .0403 inch in diameter, insulated to 4-32 of an inch, with the best quality of waterproof insulation is to be used, clamped to the wall by wooden cleats, if possible.

The wires should enter the building through hard rubber tubes, which are so inclined that no water can leak in. From this point to the roof rubber-covered wire should be used, extending to the overhead conductors, all connections being made with McIntire sleeves or soldered. The line wires should be hard-drawn copper, having a diameter of at least .08 inch, and supported every 125 feet. Copper wire is recommended on account of its low resistance, its low electro-static capacity, as compared with iron or steel wire of the same conductivity; its low co-efficient of self-induction, and especially its durability. There is little depreciation in copper wire after it has been strung, the gases common to large cities having very little action upon it, and its life is very many times greater than that of iron or steel wire, thus rendering it in the end the most economical.

In making joints in hard-drawn copper wire the McIntire sleeve should be used. In building the loop, both sides of the circuit should occupy adjacent pins on either house-top fixtures or on pole lines, thus causing the relative

distance of the two sides of the circuit toward foreign wires, to be the same throughout their course. This is of great importance if the loop is of sufficient length to render transposition necessary. On exposed house-top fixtures nothing but waterproof insulated wire is to be used. From the cable fixture bridle wires, not less than .0403 inch in diameter, insulated to 5-32 of an inch with the best quality of waterproof insulation, extended through cleats on the under side of the cross arm to wooden ducts fastened to the back of the cross arms, or through properly constructed cables, should lead to the cable box or tower. The bridle wires should be joined to the line wires either by McIntire sleeves or by soldering. Care must be taken not to solder to the line wire between supports, as heating the hard-drawn copper anneals it and reduces its tensile strength.

Inclosing the cable terminal we have used a dust and moisture proof iron cable tower, cylindrical in shape, built completely round the pole, and supplied with a suitable platform and railing. A complete description of this tower may be found in the report of the last cable conference. If a wooden box is used it should be made of 1½ inch pine, tongued and grooved, having double doors hinged at the top and opening together. Its interior dimensions should be sufficient to give a space ample for placing the cable head, lightning arresters and bridle wires. The box should be well oiled on its interior and painted thoroughly on the outside before placing in position, the joints being white leaded before the box is put together. The terminal tower or box is to be locked, and it is reccommended that a standard padlock be adopted and used for this purpose. In this tower or box the bridle wires are connected to the plate and fusible arresters. To protect the cable against heavy electrical discharges, we provide at the exterior terminal fusible coils and properly constructed plate or pointed lightning arresters. The fusible coil at this point is so designed that it burns out with a current of one ampere, thus having twice the carrying capacity of the central office arrester; this protects the cables and prevents a large number of burn-outs at points remote from the office, locating most of them at the office terminal, where they may be quickly repaired. The outside wires extend first to the plate arrester, which discharges the lightning to ground at the cable pole and prevents the burning out of many fusible coils. The ground plates upon the arresters should be connected to moist earth by means of conductors run independently of the cable sheath, and having three times the conductivity of the line wire. For this purpose three No. 12 hard-drawn copper wires twisted together may be used. The arresters should be connected to the cable heads by waterproof insulated wire.

The binding posts on the cable terminals should be arranged in pairs, so that the two wires of a pair will be exactly opposite each other horizontally. This form is described in the report of the last Cable Conference; its advantages are apparent at once. If a form of cable is used not requiring a permanent head, it may be connected directly to the lightning arrester binding posts in the order recommended above. We recommend, especially at the cable head, that nothing but lock-nut binding posts should be used.

The underground cable should extend from the subway to the fixture at which the terminal is placed through a 3-inch iron pipe. These cables are

usually led to and enter the office building in a great mass of ducts. At the point where they enter the office it is of especial importance that each cable should be available for handling at any time. It has been found that a symmetrical method of leading cables, from any massed run into two vertical lines, hanging them on cable hooks attached to posts or to the walls of the building, provides a plan whereby any one cable may be reached as desired. At each angle, or, indeed, at each point at which it is ever expected to reach and handle the cables, some such arrangement should be made. In many of the present large underground systems no provision has been made for this purpose. The cables have been pulled in indiscriminately and no regular method of attachment has been provided. As a result, in what are purported to be drawing in and drawing out underground systems, it is even now becoming very difficult to do the work of drawing in, and wholly impossible to do the work of drawing out specific cables without interrupting the whole system. This is apparently caused, first, by the very limited area of the underground manholes, and second, by the failure to provide a comprehensive system, by means of which every one of the undergound ducts may be utilized as desired. In making a recommendation for a central office we are brought into consideration of the larger subject for the telephone building itself. This should be designed especially for the occupation of the operating switchboard, and its necessary adjuncts. To that end the building should, first of all, be fireproof. The operating office should be on the top floor. Provision should be made for leading the underground cables to a shaft of suitable dimensions, extending to a room which should be set apart for the terminals, distributing and testing purposes. Near to this should be a battery and power-room of ample dimensions, providing for the generators, motors, main and testing batteries, with the necessary water connections and other appurtenances. The form of the operating room itself would, of course, depend largely upon local conditions. One of the chief requisites should be the anticipated ultimate capacity of the exchange. In general, if it is necessary to deflect the board from a straight line, it is better to have the operators work from the inside of a circle than around the outside, the arrangement being such that all operators are at once within view of the chief operator. The office should be free from elevator shafts or other obstructions, and should not be made a passageway for employees in reaching the roof or any other part of the building.

In view of the specific purposes of the telephone building we think that, before plans are made for it, the telephone engineer, together with the architect, should definitely lay out the space to be occupied by the different departments which are to be devoted to the business, and especially their relation to the operating room, as it is almost impossible in a building already completed, or having plans laid out independent of this purpose, to arrange a telephone plant to the best advantage.

The underground cables extending to the operating office should be of the well-known Conference Standard, No. 18 B. & S. gauge wires, twisted in pairs. At the central office end these cables should extend to a room just as near the operating office as possible, where they should be headed and connected to fusible arresters which will burn out with a current of half an ampere. From these arresters the circuit should be led by office cables, twisted in pairs, to the

terminals of the distributing board, the opposite terminals of this board leading to the operating switchboard. This distributing board should be made in such form that wires may be led at any time from any point on the line terminals to any desired number on the switchboard terminals, it being so arranged that even when fully occupied all distributing wires are available for handling as desired. The distributing wires should be rubber covered, twisted in pairs, and soldered at the connections.

It is especially recommended that the cable heads be mounted on a fireproof fixture, and that the distributing board be made fireproof.

When arranged in this manner the circuits are available for testing purposes at the fusible arresters, where they may be tested out through the underground cables or in through the distributing and operating switchboards. When an office is so arranged, it is of advantage, therefore, that the testing should be done in this terminal and distributing room, and that this room should be accessible without passing through the operating room. The terminal and testing room should be in charge of the chief inspector by whom all circuits should be tested, and who would have charge of the general trouble work of the exchange. There should be supplied for his use a telephone outfit, with connections to the office manager or chief operator, circuits through the operating board, a circuit to the generator and power tables, and also to plugs available at the cable heads, by means of which line or office tests may be made. He should have, also, a Morse outfit with relay and key, with a battery circuit included, and be supplied with a galvanometer outfit and a Wheatstone bridge.

While it is not recommended that at every exchange office there should be kept additional and more delicate instruments for making insulation resistance or capacity tests, it is expected that in each company these appliances are available, and they may be connected for such tests through the chief inspector's apparatus.

In the operating room of the larger exchanges we recommend that there be placed a multiple switchboard adapted for metallic circuits. This will extend, preferably, in one line at about four feet from the wall. The number of circuits terminating at each section of the board will largely depend upon the average daily use of the telephones in the exchange. Broadly, however, it may be stated that one operator will handle 100 lines, if not burdened with the making of tickets or the handling of incoming local trunk wires. If branch offices exist in the exchange, the incoming trunk wires are preferably to be handled on the first one or two sections of the board, and the toll line business preferably handled at the first section. At this section connections may be made requiring tickets or other record, such as checks on toll or long distance business. If incoming trunks from a branch office are handled, they should be operated preferably by operators having in connection with their telephones a "talking circuit," its two branches extending "open" to the branch exchanges, so that calls received by these operators would be through his telephone. The trunk lines should be so arranged, however, that they may be operated by ringing calls, in the usual manner, if desired, without regard to the talking circuit.

At the subscriber's sections three operators' outfits should be provided in the usual manner, excepting that double plugs, cords and ringing keys are used,

and the talking circuit is bridged, not looped. The line circuits would extend through this board in the usual manner, the line and test wires being twisted together in pairs throughout the cables and operated as the two sides of the metallic circuits. After passing through the last multiple board the circuits would extend through an intermediate distributing board, placed preferably immediately back of the multiple sections. At this board the circuits be may distributed to such answering jacks and drops as may be desired. These answering jacks and drops are arranged in front of each operator, the drop being of high resistance and retardation, preferably of what is now known as the tubular pattern and bridged across the circuit which extends from it to the answering jack, where it is to open until a plug is inserted. By this arrangement the line drop itself is used for the disconnection signal. The advantages of having the line and clearing out drops identical have been appreciated within the last two or three years, especially in the use of single cord boards, in which type of board the work of clearing out and watching connections is probably better done than in any other. In a board so arranged it will be seen that when two metallic circuits are connected together all the advantages of a metallic circuit are preserved. In all cases grounded circuits, extended to the exchange through metallic circuit cables, should be connected to ground at the outer end of the cable, the unused wire of the pair being grounded at that point. Therefore, when a grounded circuit is connected to a metallic circuit by means of this return wire, the advantages of the metallic curcuit are extended to the outer or grounded end of the cable, from which point, of course, the single wire will be subject to such interferences as its exposure may bring into play. The return wire is by no means thrown away, but is thus utilized throughout the cable. When two grounded wires are connected together they are practically preserved from interferences from adjacent wires throughout the cables and the operating apparatus by the shield of the twisted mate, which is grounded at its extreme ends. As all of these wires enter the office in pairs, it is essential that the use of each wire of a pair should be distinguished throughout its entire length, and it should be provided that in the cables, as well as throughout the switchboard, the white wire be used for the line and the colored wire for the test.

With the extension of metallic circuits it is often asked how they may be utilized for the service of two or more subscribers on the same circuit. Probably the best results are accomplished by bridging the different instruments on to the two sides of the metallic circuit, using a ringer magnet at each instrument of high resistance and retardation. By this arrangement the electrical balance is preserved, and no alteration in the ordinary form of operating apparatus is made necessary.

It has been the practice heretofore to loop intermediate sets of instruments into a circuit. At first this practice was persisted in when metallic circuits were introduced, additional instruments being looped into one side of the circuit. Such an arrangement, however, destroys the balance, and the instrument so connected will be subject to disturbances as loud as the line is capable of producing, and it will also be a source of disturbance to the other instruments in the circuits. By connecting all instruments, however, in multiple arc, bridging across the circuit, nothing is lost in transmission, if the coils have sufficient

retardation, and the electrical balance necessary to the proper working of the metallic circuit is preserved. Systems have also been devised whereby a third ringing wire is legged on to the metallic circuit extending through the ringer magnets of all the instruments. This wire is open when the telephone is removed from the hook. It seems that at the time this latter plan was thought of, the successful results of the bridging in system had not been appreciated. In a number of instances attempts have been made to eliminate disturbances on grounded wires from electric railways and electric lights by the use of a common return wire. While this has been of advantage in some cases in connection with single wires, the common return has no advantage as forming a part of a metallic circuit, and its use in direct connection with a metallic circuit is not to be thought of.

With circuits arranged as detailed above, the entire central office and cable plant is provided against inductive interferences originating within their limits, and the exchange is in condition to be easily changed to a complete metallic system.

Of course it is recognized that very many of our large exchanges equipped with multiple boards, are now wired only for grounded circuits, and are, therefore, not to be operated on the plan indicated. There are, however, at these exchanges demands for metallic circuits and instruments to be used for local and long distance work. By their use advantages are obtained in largely overcoming local inductive interferences. Such circuits may be arranged advantageously on the plan of what is known as a combination loop. This is a local metallic circuit so arranged as to extend as a metallic circuit through the long distance or metallic circuit switchboard, where one branch is grounded, the other branch extending in the ordinary manner as a single wire through the local exchange. Locally the wire is handled in the usual manner. At the combination board, however, the circuit extends to two jacks and is handled by means of a twin plug. If, in combination with a multiple board, the jacks are so arranged as to provide the usual "busy" test when a plug is inserted, the circuit led by the twin plug and double cord at this combination board should have all the advantages required for long distance work. It is also found that in grounded circuit multiple boards very much of the induction which is occasioned by the old method of wiring may be overcome by using double plugs and cords, the outer shell of the plug being connected directly to the ground, by means of which the test ring is grounded independently of the line wire. During the transition period from grounded to metallic circuit apparatus, therefore, we would recommend the use of the combination board, and of the double plug and cord in connection with a multiple switchboard. It might appear at first that by using double plugs and cords on a multiple board wired on the old plan, the apparatus throughout could be operated for metallic circuits. This, however, is not the case, as owing to the fact that the wires are not twisted in pairs there is actually more induction between wires in the board when operated as metallic circuits than on the plan indicated for operating grounded circuits.

At many of the eastern cities through which the main lines of the long distance company pass, special metallic circuit switchboards have been placed for

the purpose of handling these circuits and such local metallic circuits as were to be connected to them. In order to avoid all possible leakages or troubles in these boards it has been thought advisable to connect each wire of the metallic circuit to a separate spring jack. These jacks are arranged in pairs and handled by means of a twin plug. This consists of two ordinary round plugs in one handle. Adjacent to this board is placed a testing board through which the wires pass, and at which they may be handled for testing purposes in either direction. In connection with one or more of the local circuits on the board are placed repeating coils which terminate in single lines in the local exchanges. The form of the repeating coils and the method of connection are now well known. In connection with these switchboards are the long distance metallic circuits.

In the building of these lines probably more attention has been paid to the requirements of a high class service, than in any other existing plant. Their record in maintenance and in service performed during the last three years is too well known to need comment. It is of interest, however, to state that on the oldest of these extensions, the line of twenty-five wires between New York and Philadelphia, there are probably to-day fewer interruptions than at any previous time, the line having shown absolutely no deterioration.

On these long distance lines the problem of overcoming inductive interference from one circuit to another, proved a very serious one. A system for so transposing the wires that no inductive interference exists between the pairs, was, however, devised, and has been reduced to practice.

In ordinary pole lines where the wires are placed on cross arms twelve inches apart, it is found that the inductive interference between adjacent metallic circuits experienced in an exposure of one mile is not serious, using the present long distance transmitter and hand telephone.

Adopting this as a basis, the systematic plan of transpositions provides, that at distances of one mile, the two branches of the metallic circuit, on which the disturbing effect is experienced, are so transposed that when the distant end of the line is reached, each branch of the circuit has had a like amount of exposure to the adjacent wires. When metallic circuits are arranged in this manner inductive disturbances are entirely overcome. Where disturbances are caused by electric light or electric railway circuits, of course transpositions must be made more frequently, as the amount of exposure which may be tolerated depends upon the intensity of the disturbing currents. Transpositions have been best handled mechanically by the use of a special double transposition insulator, recently devised for this purpose. This arrangement consists of two insulators, one being placed immediately above the other. The lower one has a hole through the top and the pin extends up through it ; the upper one is then threaded on the top of the pin. In order that ordinary pins may be used, a threading tool has been devised by means of which any pin may be turned down to the desired dimensions. During construction in transposing, the left hand wire of a pair is brought around the upper insulator and then extended parallel with the cross arm, back of and around the upper right hand insulator. The right hand wire of the pair extends around the right hand lower insulator along the arm, and back of and around the left hand lower insulator. The wires are

tied at each insulator in the usual manner. Where existing circuits are to be transposed, of course the wires in either direction must be "dead ended" at the respective insulators, and it is then usual to make the transposition by means of a short piece of insulated wire drawn tightly across the two wires. Where a large number of wires are to be transposed, the plan of arranging them properly becomes more involved, and should be laid out by a competent telephone engineer.

If a metallic circuit for telephone purposes is constructed upon plans properly laid out, every particle of outside disturbance may be overcome and the service may be made perfect. Any falling away from the high standard of these plans, however, at once detracts from the results, and should not be tolerated.

It must not be thought that what we have called "The New Era in Telephony," the various details of which we have attempted to describe, is something entirely new. This is not the case. To-day it is a commercial factor for which the public is making loud demands. Many of our largest exchanges have been reconstructed to meet the new requirements. New York, with a present office equipment for nearly ten thousand lines and nearly fifty miles of Conference cable in circuit, is in the lead. In Buffalo and New Haven the entire exchange plants are being rearranged, while in Baltimore and in eleven New England cities metallic circuit operating apparatus is shortly to be placed.

Although individual discoveries and inventions will undoubtedly lead to improvements in the detail of the appliances involved, yet we think that it will be by adhering to uniform practices, by a concerted action on the part of the companies taking up the new service, and a careful consideration of their experiences, that the greatest improvements may be looked for.

During the past very much has been lost by a lack of uniformity and by the failure to find out and use what was really the best in appliances and general plans for the service. The methods of the east and the west have differed widely, and in some localities the business seems to have been run on the assumption that it was not there subject to the same electrical and natural laws as elsewhere. As a result there has been no fixed standard of telephone exchange service.

We have never heard of any exchange that its service was too good. This is, perhaps, owing to the nature of the business itself, and yet it is in spite of the very best efforts of telephone men and the liberal expenditure of money in providing what was thought to be best. There is probably no exchange to-day that does not represent what was thought to be the very best engineering at the date of its construction. In the light of modern development, however, we see in these existing plants too many wires in single cables, too small wire, rusted out plants of iron or steel wire, deterioration of insulation in outside or inside wiring, twenty different styles of battery in service, as testimonials of the dearly bought experiences of the past. We see also some exchanges overcrowded with operators, working as if the service was to be performed by the force of numbers. In some the benefits of modern appliances are lost because of the lack of proper utilization. One exchange, for example,

shows you three hundred subscribers' lines terminating on one section of multiple switchboard. In another you will find less than one hundred. It will not much overstate the case to say, that in making plans for telephone exchanges, either the plans of similar establishments elsewhere have not been studied at all, or if they have been studied the judgment of them has been so influenced by local conditions as to preclude their possible benefits. In this "new era" in which a perfected service is to be given, such engineering cannot possibly be successful. Our companies are now unanimous in telling us that nothing is too good for the service. Unfortunately to those in direct charge of the service, the statement means very little. What is needed is some source of information from which we may learn just exactly what is good for the service. May not this Association whose membership comprises all well known experts and telephone engineers, keep posted in telephone matters in various localities and determine, for mutual benefit, the best practical plans for telephone work? Thus, there might be furnished to the companies included in this Association detailed plans covering every branch of the telephone service, by means of which we may raise the standard of workmanship in our employees, remedy, as far as possible, the effects of the loose methods of past years, and properly provide for the requirements of the future.

The new era in our business has dawned brightly; our patrons see and appreciate it; skillful engineering will provide for its needs, and eternal vigilance will preserve it.

THE PRESIDENT—Gentlemen, you have just heard the paper describing "The New Era of Telephony." Are there any remarks? (after a pause.) There seems to be no disposition to make any remarks on this paper. The Association will have to determine whether it shall be printed or not.

MR. METZGER—Mr. Chairman, in order to bring this question up before the Association, I move that this very valuable paper be received by the Association and placed in the hands of the Secretary, but not for publication.

MR. STONE—With the consent of Mr. Metzger, I would add, that the thanks of the Association be tendered to Mr. Carty, and with that amendment I would second the motion.

THE PRESIDENT—The Chair would state, in order that there may be no misunderstanding about this paper, that it is the joint work of Mr. Hibbard, Mr. Carty and Mr. Pickernell.

MR. STONE—I move that thanks be extended to all the gentlemen. It is certainly a very valuable paper.

MR. SMITH—I rise for information as to whether the motion means that it shall not be printed in the proceedings, or in the daily press?

THE PRESIDENT—As the Chair understands it, it is to file it with the Secretary without being printed in the proceedings or in the papers.

MR. SMITH—The paper is a very valuable one, and a good many of us did not hear it plainly. The greater part of it is statistical; I do not know how we can get the benefit of it, unless we get the copy in some shape.

MR. TYLER—I move to amend Mr. Metzger's resolution by striking out the word "not."

This motion was seconded by Mr. Wilson.

MR. TYLER—Mr. President, that will leave the resolution, as I understand it, substantially this: that the paper be accepted, and be placed in the Secretary's hands for publication. Mr. Metzger's resolution is that it be placed in the hands of the Secretary "not" for publication. My amendment is to strike out the word "not."

THE PRESIDENT—The question before the meeting is Mr. Tyler's amendment to Mr. Metzger's resolution.

Calls for the question.

MR. DRAKE—I move, as an amendment, that the paper be published in the proceedings of the Association, that is, that it be published in the form usually issued by the Secretary, and not otherwise.

MR. TYLER—I accept that amendment.

A vote was then taken on the amendment, and a rising vote showed 11 ayes to 9 nays.

THE PRESIDENT—If it be the desire to vote with all the strength of the Association, then we must see if each one of the votes as cast is legal, that is, one vote for each member of the Association. There are several representatives of each of the Companies which are members of the Association here. In a case like this, if it is the desire of the Association, the roll may be called. I consider that paper very valuable, and one that should be circulated throughout the telephone fraternity. It should be printed as part of

the proceedings of the Association, but I do not think it should have the endorsement of the Association. We do not propose to give it our sanction. Many papers may be read here which I would not sanction, and you would not sanction, and I do not see why the Association should be responsible for a paper read by an individual. This paper has many good points, and I think, therefore, it should be published. The Chair would state, as his belief, that the Association is not responsible for the opinion expressed in these papers. We simply listen to these papers, and print them. They are the opinions of individual members who are authors of the papers. It has been stated by one of the members that this paper was backed by the American Telephone and Telegraph Company. That is not so. It is simply the opinion of three of their experts.

MR. YOST—I would be very glad to have many such papers as that, because it is a very valuable one; but it should be stated in the published proceedings that these papers are not endorsed by the Association, only published as part of the proceedings.

The Secretary then called the roll, and there were found to be 13 ayes and 11 nays.

THE PRESIDENT—The amendment of Mr. Tyler to the resolution of Mr. Metzger is therefore carried, and the question recurs on the original resolution as amended.

Calls for the question.

The Secretary again called the roll, and reported 13 ayes to 11 nays.

The President declared the motion carried as amended.

MR. CRANDELL—I will make the following motion:

Resolved, That this Association disclaims responsibility for any paper read at its meetings, unless so expressed by a special resolution.

THE PRESIDENT—The Chair thinks that it is unnecessary; this Association has never been responsible.

MR. STONE—I move the adoption of the resolution.

This motion was duly seconded, put, and carried unanimously.

THE PRESIDENT—Gentlemen, we have agreed to accept an invitation to go to the State Agricultural Fair to-morrow at one o'clock.

On motion, duly seconded, the meeting then adjourned until 10 o'clock, A. M., Wednesday, September 11th.

SECOND DAY'S PROCEEDINGS.

WEDNESDAY, September 11, 1889.

The Convention was called to order by the President at 10 A. M.

THE PRESIDENT—Before beginning the reading of the papers, the Chair wishes to announce that five minutes time will be given to all those present who wish to accept the invitation of the Northwestern Telephone Company, to hand in their names to Mr. Glidden. He says every name should be handed in at once, and members are requested to avail themselves of this opportunity.

The representatives of the American Bell Telephone Company wish to announce that they have quarters at Room 122, where they will be glad to receive their friends at all times.

The Chair will announce that this is an adjourned meeting of the Executive Session of yesterday afternoon.

There are some photographic views on the Secretary's table of the effect of the sleet storm in Kansas City. Any members who may desire to see the effect of a sleet storm can do so by visiting the Secretary's table.

As we shall have to adjourn this session at 12 o'clock in order to reach the Fair Grounds, it will make a short session, and it seems to me that it is desirable that we should arrange at once for a special session to-night. It would be well to pass a resolution that we meet at some convenient hour to-night, so that we may close up the business of the meeting, if possible, to-day.

MR. EASTABROOK—I move that the next session of the Association be at 7:30 to-night.

This motion was duly seconded, put, and carried.

THE PRESIDENT—For the information of the members, Mr. Glidden informs me that the trains for the Fair Grounds will leave at 12:15 P. M. and 12:45 P. M., from the Union Station. Mr. Glidden suggests that the 12:45 train is the most convenient one to take; and also states that carriages have been provided to take the ladies to the station, and to meet them at the station on their return, to take them to the Flouring Mills, and then return them to the hotel.

THE SECRETARY—There is one thing more, Mr. President. The representatives of several of the lines of railroad from here to Chicago will be in the hotel during the morning prepared to take the names and secure accommodations for all those who wish to go East, and attend to checking baggage. Some of the roads represented are the Wisconsin Central, the Chicago, Milwaukee and St. Paul, St. Paul and Kansas City, and you pay your money and take your choice.

THE PRESIDENT—The next paper to be read is "Underground Construction in Brooklyn."

Mr. Reilly, the author of the paper, not being present, and as I am probably more familiar with this paper than any other person, if Mr. Storke will take the chair I will read it.

Mr. Storke then took the chair.

MR. SARGENT—This paper has been prepared by Mr. Reilly, General superintendent of the New York and New Jersey Telephone Company, and it is a continuation of the papers I have read to the Association for several years past.

Mr. Sargent then read the following paper:

UNDERGROUND CONSTRUCTION IN BROOKLYN.

BY J. C. REILLY.

This statement of underground construction in Brooklyn is submitted in continuation of the papers upon the same subject by Mr. Sargent, read at the Conventions held in 1886, 1887 and 1888.

Our actual underground extensions during the past year have been limited to about half a mile of conduit, the duct length of which is 1 8-10 miles, and to

placing 1 7-10 miles of cable. In connection with the underground system, however, we have placed upon the Elevated Railroad structures 3 7-10 miles of cable, with 5 3-10 miles of distributing duct, and connected through this duct 553 subscribers.

The completion of 17 miles of elevated railways throughout Brooklyn, upon which we have the right to place cables and wires, made any immediate extension of our underground conduits unnecessary.

Our present mileage of conduit, cables, etc., is as follows:

	Underground.	Elev. R. R.	Total.
Miles of conduit	15.8	5.3	21.1
Miles of duct	100.1	5.3	105.4
Miles of cable	24.3	13.7	38.
Miles of conductor	2,339.9	1,294.7	3,634.6
Miles of conductor working	1,327.2	679.3	2,006.5
No. of subscribers connected	2,002	553	2,557
No. of cables connected	44	15	59

Our method of distribution from underground cables by means of terminal poles or house-top fixtures, has been modified to a great extent by the facilities offered by the Elevated Railway. The method of distribution from the Elevated Railway structures is as follows:

Terminating either an underground cable or a cable placed upon the structure itself, at some convenient point on the road, we run from that point, in a distributing box, 6 inches square, along the footway between the tracks, rubber covered wires to the points opposite where it is desired to branch them off. The wires are dropped through holes in the bottom of the box, run along the cross-girder of the road to the curb line and jumped directly into the subscribers' offices, or to a branch pole line or house-top fixture. Where there is a group of subscribers in a block, it is the practice to branch a cable containing ten to twenty-five conductors, from the main cable on the road, to a convenient point in the blocks and distribute over house-tops from there.

We had decided to place some thirty miles of conference standard cable in our underground conduits and upon the Elevated Railroad structures during the year, but we were fortunate in perfecting and applying a very simple and effective method of transpositions, which enabled us to reduce our cable purchases one-half. This was foreshadowed by Mr. Sargent in the following paragraph, read at the Convention held in New York in September, 1888:

"The transition period between grounded and metallic circuit systems will "be very troublesome and annoying, and may last several years. It is our in- "tention in ordering the type of cable just described, to make provision in the "manholes for joining the sections together by devices, which will enable the "joints to be opened readily without cutting the cable and the pairs broken up "in order to avoid cross-talk on grounded circuits, and, at the same time, allow "of access to them for straightening them through when twisted metallic "circuits are required. The necessity of getting at the joints in this way from "time to time, and the space required to accommodate connecting boxes, is "another argument in favor of large and commodious manholes."

As the results obtained may interest the members, it might be well to state that four cables of the Conference standard type,

Number 1.....3,000′	Number 3.....6,655′
Number 2.....5,310′	Number 4.....7,500′,

were connected up and in use by subscribers, the twin wire in each case being grounded. Requiring additional conductors to the points reached by the cables Numbers 1 and 2, we attempted to use a number of the twin wires for subscribers. After one week's trial we were compelled to reach these points by other routes, and cut out of the cables on account of complaint from subscribers of constant cross-talk. We then, during several succeeding Sundays, introduced transposition plates at splices from 500 to 700 feet apart, and connected the subscribers through, using the wires indiscriminately. Cables 3 and 4 were transposed in like manner, and we are using from 60 to 92 conductors in these cables for subscribers, and there is, even on the longest length, 7,500 feet (with 92 wires working), but very little cross-talk noticeable at any time. Other cables connected in the same way since February last give like results. In each cable a number of circuits are connected straight metallic to provide for trunks and metallic circuit subscribers.

The transpositions are made upon hard rubber plates 3½ inches wide by 17 long, fitted with spring contacts. When attached by screws to a similar plate to which the conductors of the cable sections are connected both plates are enclosed in a copper junction box. The lid of the box can be easily removed when it is desired to restore the pairs of the cable, which is done by substituting for the transposition plate, another plate connected regularly in pairs. Close observation of the creosoted conduit and the lead-covered cables, laid at various times since 1884, seems to prove that the destructive agent usually present in freshly creosoted wood, disappears almost entirely after a few years.

As supporting this statement the result of several investigations is submitted.

A Western electric cable purchased in 1886, and placed in the 1884 conduit during 1887, over two years ago, shows but very slight trace of action on its surface at this date, while part of the same cable laid in the 1888 conduit when completed shows quite a scale of carbonate of lead after one year's exposure. Parts of the same cable placed in other conduits about a year after their construction show but little damage on the surface.

A Western electric cable placed by the Metropolitan Company late in 1885 in a creosoted conduit between the Brooklyn Central Office and the Brooklyn Bridge, when examined a few days since, after three and a half years' exposure, shows a slight crust of carbonate, principally on the upper part. A New York and New Jersey cable laid in the same conduit in 1886 is in the same condition. We do not anticipate the loss of either of these cables from the action of gases. To further test the effect of time and ventilation on creosoted wood, we placed samples of the Western Electric and New York and New Jersey cables, covered with the alloy of lead and tin, in a box made of creosoted wood, which had been on hand in the yard for two years or more, and samples

of the same cables in a box made of creosoted wood which had been on hand about eight months. After being sealed up for three months the boxes were opened, and the samples in the old wood box were found to have but infrequent patches of what is known, chemically, as phenolate, while the samples in the box made of the later lot of wood were thickly covered on the sides and top by phenolate. Either phenol, a volatile gas, or acetic acid in combination with carbonic acid gas, will reduce lead to carbonate of lead. There being no acetic acid in the wood properly treated with dead oil of coal tar, and the phenol escaping, by evaporation and ventilation, the carbonic acid gas present will, in all probability, have no more effect on the lead covering than if the cables placed were in ducts of iron or other material. It would seem desirable, therefore, before placing creosoted conduits underground to expose them to the air, or to artificial means for evaporating the phenol from the creosote, if the latter cannot be obtained free from it. There seems to be no doubt as to the durability of creosoted wood. Frequent examinations during the past five years show there is no decay of the wood, or change of any kind to cause injury in placing or removing cables. Its economy, flexibility and safety strongly recommend its use for conduits.

Our examination of the cables in use seems to show that there is a difference in the metal alloy. The Western Electric cable, covered with the alloy of lead and tin, placed January, 1885, in a conduit completed the previous month, is, to all appearances in as good a condition as when first laid, nearly five years ago. It will be remembered the cables covered with pure lead and placed at same time, were destroyed and removed from this conduit within two years.

A Western Electric cable, supposed to be covered with the alloy, purchased in 1886, and placed in the conduit in 1887, with cable referred to above, shows a slight trace of carbonate, while part of the same cable placed in a newly laid conduit is severely attacked, as stated in remarks on conduits. The cable first referred to above is in fact the only one we have which can be said to show no action on its surface. We are now having chemical tests made on specimens of several cables, to determine, if possible, the difference in their composition.

The practice of ventilating the conduits and manholes as they are constructed by lateral branches to poles and house-tops, and to which we ascribe our freedom from explosions, has been extended considerably during the past year by placing 3-inch iron pipes from manholes to the columns of the elevated railroad, which serve the double purpose of ducts and ventilators. The quantity of gas in conduits and manholes has been sensibly reduced, and in two instances where conduits entered the Central Office basements, the odor of gas, which it seemed impossible to entirely exclude, disappeared entirely after the manholes outside were connected to the elevated railroad structure by a number of 3-inch pipes. A large tube leading to a dead chimney at this office, in connection with pipes to elevated railroads near by, usually keeps the large tunnel through which the conduits enter the building tolerably free from gas.

We believe ventilation of this kind is the easiest and best method of preventing the explosions in manholes occasionally reported from other cities.

Experience confirms our belief that manholes should be made large and

roomy, with hooks or guides on the sides where cables and junction boxes may be arranged, out of the way of workmen engaged in drawing cables in and out.

Except the cables removed on account of destruction of the lead covering, we have had no special trouble with either cables or terminals, and the electrical condition of our cables remains practically as reported last year. All cables connected during this year give satisfactory results in insulation and capacity.

Mr. Sargent then took the chair.

THE PRESIDENT—Gentlemen, you have just heard the paper on "Underground Construction in Brooklyn." Are there any remarks?

MR. METZGER—I would ask the Chairman in regard to the transposition plates and junction boxes. Do you put anything else in, beside simply the cover of the box? Any paraffine, etc.?

THE PRESIDENT—No, sir.

MR. METZGER—Does it successfully keep out the moisture?

THE PRESIDENT—It has proved to so far. They have not had a test in a very long time, but as they are sealed all perfectly air-tight, and moisture-tight, I see no reason why there should be any difficulty.

MR. METZGER—I had an experience of that kind myself some years ago, sealing up a box air-tight, and yet moisture seemed to go through the iron, and all wires in there became as damp as if they had been dipped into water. The moisture seems to penetrate the galvanized iron. I do not know whether your experience has been of such a character or not.

THE PRESIDENT—The boxes are sealed up just as tightly and are just as dry as lead pipe covering the cable, and I can see no reason for moisture in the box any more than in the covering of the cable itself.

MR. METZGER—I merely speak from my own experience. Because, in my case, in addition to having the box sealed I had it covered with asphalt, so as to be almost sure to keep out all moisture; and yet that effect took place.

THE PRESIDENT—Our tests indicate that the transposition box does not lower the insulation. I think the longest ex-

perience we have had with them is not quite a year, but so far we have had no evidence of trouble.

Are there any further remarks, gentlemen?

MR. CARTY—Mr. President, I would like to say that in a metallic circuit, in its switchboard arrangement, the arrangement of the pairs cannot be broken up without destroying the value of that wire, every time a single wire subscriber is connected on a metallic circuit. In planning a multiple switchboard for metallic circuits and grounded circuits, we put in a transposition box to break up the pairs. In adopting metallic switchboard, in order to get the full benefit of it, you must abandon this arrangement of the pairs.

THE PRESIDENT—The reasons why we transpose the wires are economical reasons entirely. It does not give you a perfect circuit; we know that, but it does make a fair working grounded circuit, and has enabled us to utilize, as the paper states, 92 wires out of 100. There is no reason why we cannot use 100 wires; whereas if we ground the second wire, we have only 50 wires in the cable, and the effect of this transposition is that subscribers get satisfactory service through the wires. As fast as you get the metallic circuits the boxes are accessible for changing any number, and that was the principal point in advising the use of this system.

MR. CARTY—I made that remark in order that anybody having a mixed circuit would understand it was something that could not properly be introduced into their system.

MR. GIFFORD—I would like to inquire about these cables that you use for metallic circuits in pairs. When you break them on grounded circuits, about how long a section do you use between the breaking points; with how long a section could you get good results from these cables in pairs on grounded circuits?

THE PRESIDENT—The only points at which you can place these transposition boxes are in the manholes. In Brooklyn these are anywhere from 400 to 800 feet apart. The paper states that these transposition boxes were placed at distances of 500 to 700 feet apart.

MR. GIFFORD--I have a few manholes located about 900 feet apart, and I wish to ascertain whether it would be safe. I have just ordered some cable, and the conduits were put down with the idea of using grounded circuits. Buying cable to be used as metallic circuits, the idea is to break them up at each manhole, and the question is whether you think it would be safe to use the cable in that way, with sections as much as 900 feet long.

THE PRESIDENT—I am not prepared to state the extreme length of cable that can be allowed for transposition.

MR. GIFFORD—If it will work 800 feet I presume it will work not quite as well 900 feet.

THE PRESIDENT—The closer you place the transposition boxes the better.

MR. KELLER—Can you use a part of the wires in that method for metallic circuits, and the balance for grounded circuits, and use them successfully?

THE PRESIDENT—In our experience, we can.

MR. EASTABROOK—I move that that paper be accepted and printed in the records of the Association.

This motion was duly seconded, put, and carried.

THE PRESIDENT—If there is no further discussion on this question, we will hear the next paper on the list, which is, "Switchboards and Long Distance Lines on Grounded Circuits," by Mr. Drake.

MR. E. J. HALL, JR.—I rise to a question of order. I understand it has been the practice not to report or publish the discussions of the executive session, and our papers seem to be all in executive session. I only want to know whether the discussion is to be reported and published, and whether any record is being made of the proceedings.

THE PRESIDENT—The Chair will state that a record is being made of the proceedings and also of the discussions, but the proceedings of the executive session are not printed, and these papers have been provided for by special vote as to the printing, which, of course, prints them without any discussion.

MR. E. J. HALL, JR.—In that case the papers ordered

printed will be printed without any discussion of whatever nature, whether it is adverse or favorable. All the things expressed here will be lost—that is, they will not appear in connection with the paper. I think that we have found heretofore that the chief value of the papers has often been that they furnished a basis for discussion.

THE PRESIDENT—I understand that this discussion will not be printed, unless some other action is taken by the Association. The proceedings in executive session are never printed.

MR. HIBBARD—What is done with the report made by the stenographer; what becomes of it?

THE PRESIDENT—We have never before had such lengthy proceedings in executive session. I presume this report will be filed with the archives, in the office of the Secretary, where he will have the pleasure of reading it over whenever he feels like it.

THE SECRETARY—The report of the executive session?

MR. HIBBARD—Yes.

THE SECRETARY—We never had but one previous to this meeting, and that was at the meeting in New York last year. The notes of that executive session were transcribed by the stenographer, and locked up in the inside drawer of my safe, and here is the key (producing the key).

MR. E. J. HALL, JR.—Mr. President, it hardly seems to be worth while to employ a stenographer to report the proceedings, if no further use is to be made of it.

MR. KELLER—They might be valuable in some future meetings.

MR. CARSON—I would like to ask if a careful editing of the stenographer's report of the executive session would not accomplish all purposes that are to be desired by all members of the Association. Some parts of the discussion will be more valuable in the printed record for reference by the members of the Association than other parts, and these ought to be printed. It occurred to me that we might pass a resolution that the record be carefully edited by the Executive Committee, as to what shall be printed in the

pamphlet report of the proceedings, and what shall not be printed. I make a motion to that effect.

This motion was seconded by Mr. Hibbard.

THE PRESIDENT—I hope that motion will fail, because I am on the Executive Committee, and I should dislike very much to have to edit these discussions.

MR. CARSON—Everybody has confidence in the Executive Committee's judgment as to what should be suppressed, and what should be printed, and the idea of the motion was that everybody should understand that that would be done, and it would settle the thing in everybody's mind.

The Chair put the question and it was carried, there being but one vote in the negative.

THE PRESIDENT—The Chair understands that this resolution will apply to all the papers, and all the discussions in executive session during this meeting of the Association.

MR. E. J. HALL, JR.—Mr. President, I understand it should apply to all the discussions. The Association itself has already taken action as to the printing of papers.

THE PRESIDENT—I inadvertently said papers; I should have said discussions. It applies not only to the discussion of yesterday, but to that which will follow—to the discussion, and not to the papers.

The next paper is "Switchboards and Long Distance Lines on Grounded Circuits," by Mr. Drake. The Secretary will read Mr. Drake's paper at Mr. Drake's request.

The Secretary then read the following paper:

SWITCHBOARDS AND LONG DISTANCE LINES ON GROUNDED CIRCUITS.

BY FLEMON DRAKE.

The Secretary of this Association has asked me to submit some observations covering the experience of our Company with switchboards and also with long distance telephone lines on grounded circuits. Such a thing as writing a formal paper to be read before the Association, that will interest its members, is beyond my capacity. I should dread disappointing the expectation of those who suggested it, but such information upon the subjects of switchboards and long distance grounded circuits as my experience affords will be gladly placed at your command.

I think it is settled beyond all controversy that a cord and plug board, of convenient size and construction, is the best by all odds. The more simple such are in construction and mechanism, the better. We have in use in our smaller exchanges a very compact, simple affair; a strip of wood upon which are arranged ten metal plugs or points a little less than one-fourth of an inch in diameter and about an inch and one-fourth long. These have a shoulder resting on the front side of the strip, with screw and washer holding them at the back. Just above this, passing through the wood, is also placed a spring similar to those in the Western Electric spring jacks. This is fastened to the back of the strip, bends down in contact with the plug or pins at about three-fourths of an inch from the face of the strip. A hollow plug, with rubber shield attached to cord, makes the connection in the usual manner. These strips are fastened on to the switchboard frame, the same as any other strip for spring jacks would be, in rows of ten, thereby constructing a 50 or 100-wire switchboard, as desired. A false face of wood, fibre or rubber, with holes at proper places to give access to the hollow plug in connecting with the spring jack, is placed over the whole, and the subscriber's number stamped in the proper place. Any suitable annunciator can be used. This arrangement gives us a board very compact and convenient for access to all its parts. This company has only one multiple switchboard in use—that at Omaha. This is the Western Electric board, constructed in all respects the same as others, except in the matter of clearing-out drops. Owing to the system prevailing here, of each subscriber himself ringing the party he desires to talk with, it was desirable to have a drop which could be made to signal the central office, or not, at the will of the subscriber. In the place of the ordinary clearing-out drop, we, therefore, substituted a galvanometer drop. A permanent magnet suspended inside of a coil which vibrates only slightly under the influence of the generator current. On the generator is a special commutator which is put into circuit by the subscriber pressing a button, at the same time he turns the crank of his bell. This operation throws the current upon the line, affecting the galvanometer drop to such a degree as to tip the catch of the shutter, at the same time giving nothing more than one click on the bell of the subscriber with whom he may be connected. This arrangement and system has worked very satisfactorily indeed. It gives the operator less work, enabling her to handle subscribers more rapidly than if she is delayed by ringing up those who are called for. I know that it is claimed by many that it is the duty of the Telephone Company to do all that is necessary to get the two subscribers to talking, but our experience seems to indicate to us clearly that subscribers are better satisfied if they get the connection promptly and are given the opportunity of doing the calling. It occupies their mind; the time of waiting is thereby shortened (to them), and when the party does not answer, they seem better satisfied. These observations are confirmed by the reports of those who have used other systems in other cities. So far as I know, these reports are invariably favorable to our system. It is also claimed that the ringing done by the subscriber wears out the machinery more rapidly. Ours has been in use a little over two years, and we have had no more than the ordinary troubles so far. I do not see why it is not as easy to construct a bell that will last indefinitely, as far as the wear is concerned, as it is to construct a dynamo that will run for years.

Regarding the subject mentioned in the Secretary's letter—long distance lines on grounded circuits—I will say, that while our success has, perhaps, in some respects been above the average, I am decidedly of the opinion, nevertheless, that we will find it desirable to adopt metallic circuits for all routes extending 100 miles, or more. From Omaha we have circuits reaching to the following points: Columbus, 90 miles; York, 129 miles; Sutton, 145, and Fairbury, 135 miles. The circuit to Sutton is wholly hard drawn copper wire, weighing 213 pounds to the mile. The others are mixed circuits, iron and copper. We daily do business between subscribers over these circuits. Of course, in summer we experience more or less difficulty from atmospheric disturbances, and in the evening there is sometimes disturbance on account of electric light plants in the different towns through which we pass. Upon an average, one-half of the communications between these points are made direct between the subscribers, without the assistance of the operators.

Notwithstanding this showing, I am satisfied that it would be better for ourselves and our customers that we make each of these a metallic circuit and work it as such. Our business could easily be increased fifty per cent. thereby. In considering the economic phase of long grounded circuits, I am fully satisfied that no telephone company is justified in making a low rate for long distances; that there is much more profit in working a short circuit at a low rate and charging a good stiff rate whenever a circuit of sixty miles and over is used.

If it should appear from this statement that we have a greater degree of success in working our circuits than is obtained in the East, I would attribute it, I think, to our comparative freedom from the disturbing influences of other lines—of the telegraph, motor, power and electric light. Without a doubt, the proximity of earth circuits have a marked effect. As an illustration, I may mention that we talk as well, ordinarily, from Columbus to York by way of Omaha, as we can from either York or Columbus to Omaha alone. That you may comprehend the peculiarity that I mention, I will state that both towns are nearly west of Omaha, Columbus 90 miles, and York 129 miles by wire, and the latter about 50 miles south of Columbus. The wire to York makes a detour to the south, through Lincoln, which adds to its length. Practically, York and Columbus are the two ends of an ox-bow, and Omaha in the middle of the bow, when the lines are connected together.

We are extending our system, and probably by the time of the assembling of another Convention we shall be attempting to work a copper grounded circuit—Omaha to Kearney, 210 miles.

MR. HIBBARD—Mr. Chairman, I move that the thanks of the Association be extended to Mr. Drake, and his paper be published. In making the motion, I would add that it may be of interest to the Convention to hear what has been told me by the representative from abroad: that, at his exchange in Berlin, in which he has, I think, eleven thousand telephone subscribers in about eight exchange branch offices, it

is the custom to have the original party ring up the other party whom he wants to talk to, and it has been their experience abroad also, that it occupies the minds of the various parties—they are busy, and they do not have any feeling that they have to wait; they feel that if there is any delay it is their own fault or the fault of the party who does not answer. It is my understanding regarding the motion, that the publication is all alike, that all papers are to be published in the ordinary proceedings of the Convention, and that a vote of thanks of the Association be extended to Mr. Drake for his paper.

This motion was duly seconded, put, and carried unanimously.

MR. LOCKWOOD—Mr. Chairman, without desiring to take up much time of the Association, I would like to say that it seems to me, in regard to this paper, that while uniformity is desirable in line construction to a great extent, if possible, it does not seem to be so absolutely necessary that central office apparatus in operation should be so uniform, because the circumstances of different exchanges vary so widely. Therefore, while it will not be judicious in every place to have the subscribers do their own ringing, yet it may be the most judicious practice that could be adopted in some places. It deserves a great deal more consideration than some of us are disposed to give to it. It is a good point that while the subscribers are doing something, they have not so much time for indiscriminate abuse, and while their minds are employed the time does not seem so long, even if it be actually longer. I have been to Omaha, and have seen this exchange in operation. There is one thing that struck me very forcibly at the time, because it was rather a novelty, and that was, that the newspapers at Omaha, without a single exception, praised this exchange and its operation. I saw a great many of the subscribers also, and tried the operation of it myself, and the scheme of calling for your number, and then ringing the subscriber, did work to a charm. It seems to me it does every one of us good to hear the agreeable experiences of others in the line in which we are all interested.

THE PRESIDENT—Are there any further remarks on this paper? If not, the Chair will, with the consent of the Association, ask that the next paper, "Telephone Salutations," by Mr. R. M. Bailey, be read by the Secretary. This is a variation from the order as announced, but it seems *apropos* of Mr. Drake's paper, and I think that it had better be read at this time.

The Secretary then read the following paper:

TELEPHONE SALUTATIONS.

BY R. M. BAILEY.

With the idea that successful telephone service depends on the aggregate of many small details, I have written the following with the hope that some one of the many practical persons among you may present a remedy for the points of defect noted.

It has been customary, in all ages of the world, when persons meet, that salutations, more or less elaborate and courteous, be exchanged, and the peculiarities of different peoples in this respect has been a fruitful source from which many writers and lecturers have drawn.

On the advent of the telephone, the want was immediately felt for some form of salutation, which should have the effect of attracting the attention of the party at the distant station, so that conversation might readily pass between the telephone correspondents attempting it. Some bright genius suggested the word "Hello," which, by the way, is not usually approved as a proper salutation in polite society, but which, for telephone purposes, was at once generally adopted, the word having the apparent faculty of being spoken over a circuit utterly incapable of transmitting any other word in the English language, and while the word *may* be the one of all others most suitable for telephone purposes, its use has developed into most annoying abuse. With intelligent people as well as with others not so intelligent, and with telephone experts, in a great measure, it is customary to stand at one end of a telephone line, and by reiterating the word a great number of times in quick succession, entirely drown out the fellow's voice from the other end of the line, and who by going through, with energy and impatience, a similar formula, frequently mixed with anathemas against the telephone, succeeds in slowly getting into actual conversation, while the fault lies entirely with the individuals, and not with the innocent machine. What would be thought of a person entering an office or premises of any kind, knowing and seeing the proprietor there present, should he begin and persist in calling attention by repeating over and over the word "hello?"

In some mysterious manner the human intelligence is capable, if the person chooses to exercise the faculty, of recognizing the presence or absence of his correspondent at the distant end of the line. Telegraph operators are familiar with this consciousness; and by the use of a little good judgment people may save themselves the wear and annoyance of "helloing" into the earth for some time before the other fellow is ready to respond.

"Good morning," or some similar salutation, should be more agreeable; and it being more deliberate, has the advantage of giving the opportunity for a reply to flow over the wire without interruption, and if the conditions referred to are observed, should be ample to start two reasonable people into prompt conversation, taking into consideration the general high state of efficiency in which telephone lines and apparatus are at this time maintained. It is really wonderful how easy and pleasant an undertaking it is to converse over a properly conducted telephone line, and it is wonderful the amount of vexation one can cause for one's self if they persist in the manner referred to. Some people are strongly averse to the use of a telephone for no other reason than want of judgment and training in its manipulation. It may be said such difficulty is the result of habit, superinduced by inferior telephone service in the past and want of familiarity with its operation, so that all such subscribers are compelled to first test out their lines before proceeding with business in hand. I think such causes at this time rarely exist, and may not the habit be broken by some improvement in the system, and by courteous and careful schooling, to the end that more rapid, pleasant and agreeable service be secured, to the happiness of the customer and employee as well. Certainly much more time is used in worthless preliminaries than in actual service. Some rule, introductory, is badly needed in the operation of the telephone. Sometimes subscribers call up a central office and inquire who called them, or who it was who was talking to them a little while since, and then think it singular that the operator, in the multiplicity of her calls, should be unable to give the desired information. Again, a person calling for another is naturally desirous of being assured that he is speaking to the person he has asked for, and a person called up is naturally reluctant in answering an inquiry until one or both are satisfied of the identity of the other. All this leads to questioning on both sides, and much valuable time is thus consumed. Would it not be a good plan for each of the correspondents to announce his name or the name of his firm as the only preliminary, thus abandoning both "hello" and "who is talking?" Would not self-introductions obviate this?

The rapidly repeated ringing of call bells, although not properly coming under the head of telephone salutations, may as well be considered in this connection, and is certainly an evil of the service which should be abated; it being worse than useless in that it, like steam whistles, when much indulged in breeds contempt and carelessness as to prompt replies or observance. Switchboard operators should be prohibited from calling more than three times, spacing the calls sufficiently to allow the subscriber to arise from his chair and reach his telephone; while subscribers should have it impressed upon them unceasingly, when so addicted, that rapidly repeated calls is a hindrance to prompt service.

THE PRESIDENT—What is the pleasure of the Association as to the paper on "Telephone Salutations" just read?

MR. METZGER—I move that the thanks of the Association be tendered to Mr. Bailey for his very interesting paper, and that it be accepted and published as all other papers are published.

This motion was duly seconded, put, and carried.

MR. HIBBARD—Mr. Chairman, before this matter entirely passes I think that it has a good deal of interest. We find much valuable time wasted on long distance lines by the fact of the two fellows whom Mr. Bailey has spoken of "helloing" back and forth at each other, without getting together. I think if anybody here has any light on that subject it will be of interest to us all. I will be glad to have any information that will help us out in that way. I think that much time is wasted in that way and that sometimes one-half as much time is wasted as is consumed in the message itself. So much do we appreciate this fact that at our pay offices at which interviews are held over our long lines at high rates, the attendants make it their business to attend to the preliminary work. The boy enters the booth, asks for the party wanted, and waits until he gets him, and tells him where he is and who it is who wants him. He then says, "Wait a minute," and he then turns to the party, who at once begins his conversation. Then the distant party knows who is going to talk with him, and where he is. Of course, in all cases this is not possible, and it means the education of the public. That is a thing, however, which is always going on. As I said, if anybody has any light on this subject, it is really of interest at this time. I think the other point is especially well taken. We all realize that a prompt answer turneth away wrath.

THE PRESIDENT—Are there any further remarks, gentlemen, on "Telephone Salutations?"

MR. J. C. CLARK—The time never will arrive when perfect salutations will be made and exchanged, until the public themselves are as well educated as the operators. It is true that the companies have taken pains to train their operators, and to make suggestions as to proper address, and in calling the subscribers and getting them together, but after all, the great outside world must be instructed. It has always been true, from the time when our first parents exchanged salutations when they came into the Garden of Eden, that men have been more or less abusive and impolite, and the great public will disappear when they are singled

down to polite men, and those who respect the time and the rights of others. The operators in telephone exchanges are fearfully abused, in my judgment, and it requires more than the modicum of good nature which they possess, to always answer in the most polite way such salutations as they receive. This, however, will be corrected as time goes on, and I believe the public themselves will do their share of curtailing long salutations and conversations, and this matter will right itself.

MR. CARTY—There is one way which has been adopted in Richmond for shortening the salutations on the part of the operator, and I often thought that it would be a good idea to introduce elsewhere, if it were possible, that is, taking away their transmitters.

MR. HIBBARD—I think it might be of interest in this connection if we could have an expression as to the reply of the operator herself. I think that in all of the larger exchanges that has been improved. The operator simply answers "Number?" as if she wanted to know what number is wanted. I think that has worked very well. But oftentimes parties having difficulty in obtaining the number they wanted, have endeavored to identify the operator, and are unable to do so, making it hard for us to find out exactly what operator is at fault. In one or two exchanges the practice has been for many years to have each operator have her own number, and answer with her number. That is, if you ring up, the operator answers and says, "Number 9." For instance, the subscriber asks for whatever he may want, and if he has any difficulty he would at once remember that operator No. 9 answered him, and was in a great measure responsible for the conversation, or for what was accomplished. I think if anyone here has tried that, it would be of interest to hear how it works. I know that in the Milwaukee Exchange, years ago, that practice obtained, and I think it does now. Is not that so, Mr. Parker?

MR. PARKER—Yes, sir.

MR. HIBBARD—I would be interested in hearing from any

other large exchanges. I have tried this system in New York, and I think it has been a benefit there.

MR. CARTY—Mr. President, I think I foresee a difficulty in the general introduction upon long distance lines of Mr. Hibbard's system. You may have an operator No. 9 in New York, and also a No. 9 in Philadelphia, and there is apt to be some confusion as to which No. 9 answered the call, or made the blunder. Then, if it were generally introduced on long lines, and we should happen to get an answer from 8,807, it would take a long time, perhaps, to say all that.

MR. HIBBARD—I do not think that applies, because it ought to be understood that the operator at one end only is responsible—the operator who answers the original call is held responsible throughout the whole connection.

MR. KELLER—Cannot you locate the operator by the time the call is made?

MR. HIBBARD—It is extremely difficult on the multiple board.

MR. KELLER—We have not experienced any difficulty in locating the operator by the time of giving the call. In the New England Company it is a rule for the operators, first, when they are called, to say, "Number, please?" and when she cuts in to find out if they are through talking, she says, "All through?" That is the rule, although not followed out in all of the smaller exchanges. In the larger exchanges I think it is.

MR. HIBBARD—Can you at any time place a blunder on a particular operator?

MR. KELLER—If they will give the time, yes.

THE PRESIDENT—The Chair would suggest the idea, whether the Western Union method would not answer very well for telephone operators. Let them be identified by initials. Initials are totally different; the subscribers are all numbered, and if you repeat the numbers of your wire to subscribers, you are liable to make confusion. But the initials are distinctive, and afford a ready means of identification.

MR. WILSON—In Chicago it is the custom of the operator in answering a call to say "Number?" and she then receives the order. Our operators are all numbered. We do not allow them to give names over the wires. If any subscriber asks who the operator is, she responds with the number in order that she may be recorded or complaint made. When the operators go on duty they take a little card with them. They put their number on that card, and also the number of section of the switchboard—the place they take at the switchboard. When they leave that position to go to another position on the switchboard, if they are transferred, a note of it is made on that card. When they go off duty it is noted on that card, and they hand it in at the desk, on passing out of the office. We keep those cards, and if any complaint is made, can always tell, if the number of the operator is in the complaint; and if it is not in, and the time is given, we can always tell what operator answered to that particular section at that time. So that we are invariably enabled to locate the operator. I do not think it would be as satisfactory to an operator to repeat her number every time a call is made. We have, in our experience, a great many requests to have certain operators answer certain lines. It is a very common thing for me to receive a note from a personal acquaintance somewhere, asking me if I won't please have a certain operator put back on his line. We cannot always do that. The operator desired is not always available, and it makes more or less correspondence. When we change an operator, and a new operator performs the service entirely satisfactorily, the subscriber hardly knows it, while if we had a new number coming back, he would be asking for his old operator. That is our system in Chicago, and with the Chicago exchanges it seems to work very satisfactorily.

MR. GIFFORD—In regard to identifying the operator, I do not think it is a good plan. We have certain operators, of course, that have certain subscribers that want them on their lines. If we put another operator on, frequently there is complaint made, and I try to break up the idea of any of

these particular attachments. So I do not think it is necessary for the operator to be known at all. If there is any trouble they are required to report at once to the chief operator, who has no other duty than to attend to faults. I think the word "hello" has become so thoroughly identified with the telephone business that it is almost too late to make any change in the form of salutation. We use the word "hello" between subscribers. When a subscriber calls the operator answers "Well?" He gives his number. Then, in the little card of instructions, which I have sent to subscribers, they are told to—for instance, a man calls. He says, "Hello," We cannot stop that. He says, "Is this Smith?" "This is Jones." Then he gives his message. We instruct them to identify themselves to the party they are talking to, and nearly all subscribers take that plan. We have very little embarrassment in communicating with our subscribers on that account. About ringing. Our operator is instructed to ring once, and then take time before ringing a second time; to take a minute; if the party is not there, he is not called; he must answer after a reasonable time. If the first party does not get the second party, he rings again: the drop falls, and he asks the operator to ring again. By using a little diplomacy we get along very nicely, and every one is satisfied, and we have no trouble at all.

THE PRESIDENT—The next paper is "Dynamo Alternating Current Interferences with the Telephone System in New Orleans," by Mr. E. H. McFall, and is to be read by Mr. Crandell. This is a paper written by Mr. McFall, electrician of the Great Southern Telephone Company, giving the experiences of the troubles that company have had with the alternating current.

Mr. Crandell then read the following paper:

DYNAMO ALTERNATING CURRENT INTERFERENCE WITH TELEPHONE SYSTEM IN NEW ORLEANS, LA.

BY E. H. MCFALL.

This paper is intended to suggest to the practical ideas in the Convention, some of the interferences set up by alternating currents.

I will first give the relative positions of the respective routes in question.

The telephone route in illustration is one with which we are having the maximum amount of trouble, and that is paralleled by the Electric Light Company's main route (alternating), on opposite side of same street, and carrying six (6) circuits to a considerable distance of parallelism, and at the immediate head, eight (8) circuits, of one thousand (1,000) volts each. The extreme distance of parallelism is sixty-six hundred feet (6,600 ft.), with a separation of forty-three (43) feet, or width of street intervening from pole to pole of systems, the telephone poles being the highest, having an elevation at the lowest wire of about uniformily ten (10) feet above the electric light wire.

When the first alternating current circuit was put in operation on this route, a decided hum, and musical note, was heard in all of the telephone lines in this parallel distribution. This hum was of sufficient volume to make an attempt to carry on a telephonic conversation on any of these lines extremely difficult and doubtful. By the time the subscriber became accustomed to the disturbance the second circuit was put in operation, and another, and so on until six (6) were in full blast. The humming sound then ceased to be musical and assumed proportions of an undulatory waul, impenetrable to the deflections of the transmitter, and at times would swell in volume and graduate to a uniformity of disturbance about equal to that set up by the first circuit. This does not occur, however, at regular intervals, and becomes noticeable visually, in the increase and decrease of the incandescent light service through this system, showing that the currents were interfering with each other.

To the electric light companies this interference became a serious question, and to a great extent was remedied by placing the wires of each respective circuit nearer each other and farther from other circuits. To the telephone subscribers and exchange the hum is still there, strong and vigorous as ever.

On this route we (the telephone company) tried the return ground, covering the field of interference, but not entirely back to the exchange. The ground was located at a neutral point and gave some considerable relief, but not entirely to the subscribers connected.

We are also subjected to another cause of interference set up by the same Electrical Dynastic Imperialist. I refer to leakage, causing a frying, variable, hissing sound, alarming in its objectionable effect upon the sensitive ear, and that is contributive to a larger extent within the territory of distribution of all alternating systems, where the consequences of grounded circuits are increased by the uses of converters in their frequently exposed liability to precipitate moisture, or as carelessly located, in influences contributive.

It is doubtful, if another licensee has been subjected to the same extent of interference, and the physical facts afflicting us as above, are presented to your attention for such discussion and opinions, I trust, that will direct to a remedy other than compromise.

MR. CRANDELL—We have had so much trouble and suffered to such an extent in New Orleans, because our heaviest route is located on the heaviest route of the Electric Light and Power Company, distributing the Westinghouse

alternating system, and that seems to be the current that the electric light company is going to use principally in that city. It became so serious with us, that some months ago we asked our attorneys to obtain an injunction against them from laying their circuits where they would interfere with ours, unless they would lay them in such a manner as to protect us against this disturbance. That suit is now pending and has not been decided. We took the ground that, having obtained a franchise from the city of New Orleans to work a telephone plant in the city, that where we erected that plant prior to the Electric Light Company's erecting their plant, that we must be protected against all harm or interference. We have stated to the Electric Light Company that when the case comes to trial, where the Electric Light Company occupied a street prior to the Telephone Company, we will not ask them to protect us, but we will protect ourselves at our own expense. But where we occupied the ground first, we insist that they must so erect their plant as not to interfere with us, or pay us the amount of money necessary for us to remedy the difficulties. It makes no difference whether they or we do it, only so it is done. We hope to get the decision on this case early this fall. It is set for trial as soon as our court opens, the first of October, and we expect then to get a decision. Even if the decision on that question should be adverse to our company, we will then be in a position certainly no worse than the one we occupy now if we attempt to go in and effect this remedy ourselves, as suggested by Mr. Tyler yesterday. We thought it worth while to make a fight against these companies, and see if our rights could not be respected, and we certainly will not be any worse off, except the attorneys' fees, if we lose the case. If we gain it, it will be of importance to the companies, and I think it worth while to make them respect our rights. I think if we have property, a man has no right to come along and go into business and set up something making our property valueless, unless he pays us the value of that property. That is the ground we propose to take in the prosecution of this

suit, and we believe the courts will sustain it. We do not feel like going to the expense Mr. Tyler recommends, unless we fail to get protection from the courts.

MR. BAILEY—Mr. President, I move that this very able paper just read be accepted and printed in the usual manner as the proceedings of the meeting are printed, and that the thanks of the Association be tendered to Mr. McFall and to Mr. Crandell.

THE PRESIDENT—Mr. Bailey's motion is that this paper be received and printed with the other papers.

The motion was duly seconded, and the question put and carried unanimously.

THE SECRETARY—Mr. President, I would like to read the two invitations received for the place of meeting next year. The first one is from the Telephone and Telegraph Construction Company, of Detroit, Michigan, dated September 7th, 1889.

"MR. C. H. BARNEY, *Secretary*,

"NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

"*Dear Sir*,—On behalf of the Michigan Telephone Company and its officers, I beg to renew the request laid before the Association at the last meeting, and to renew the application for the next meeting of the Association at Detroit. The central location of this city is well known, and it is believed will afford an opportunity for the gathering of a larger number of the members who have heretofore found it difficult to spare the necessary time to attend. I had hoped personally to be with you at Minneapolis, and exceedingly regret that business engagements will make it impossible to do so. I beg, therefore, to extend to all my best wishes, and trust to meet you all at Detroit one year hence.

"Very truly yours,

"W. A. JACKSON."

THE SECRETARY—The other invitation is from the Bell Telephone Company, of Buffalo.

"MINNEAPOLIS, Minn., September 10, 1889.

"HENRY METZGER, *President*,

"NATIONAL TELEPHONE EXCHANGE ASSOCIATION:

"*Dear Sir*,—The Bell Telephone Company of Buffalo cordially invite the Association to hold its next Convention in our city.

"Yours truly,

"THE BELL TELEPHONE CO. OF BUFFALO,

"By H. C. PALMER,

"*Secretary*."

MR. KELLER—I move that this subject be made the special order of business immediately upon the opening this evening.

MR. CRANDELL—Mr. President, if places are to be selected where the next Convention is to be held, I expect to put in an application, and inasmuch as this meeting has been held at the source of that river where it never thaws, I think the next meeting should be held where it never freezes.

MR. CARSON—I want to get into the procession with an invitation for the Association to meet at the place which is very fittingly described by the last word in the name "Old Point Comfort," in the territory of the Southern Bell. I think it is hardly necessary for me to amplify its attractions. A great many of the gentlemen present have been there, and those who have not, have heard about it, and its historic associations, which are of great interest. I simply, at this point, wish to file an invitation.

THE PRESIDENT—The motion before the meeting is that these invitations be made the special order of business at the meeting this evening, at 7:30.

MR. EASTABROOK—I take it that Mr. Keller makes that comprehensive, taking up the whole question?

Mr. KELLER—Certainly; to take up the whole question.

The motion was duly seconded, put and carried.

THE PRESIDENT—Before adjourning, I will state that the business for this evening, aside from the question of the location of the next meeting, will be a paper on "Multiple Switchboards," by Mr. Sargent, and a paper on "Telephony Abroad," by Mr. Lockwood, together with the Secretary's statistical report.

MR. CRANDELL—Before announcing the adjournment, will you please state, for information, whether the members of this Convention will be expected to attend the Fair in a body, or whether we will just go as we please. If we are to go in a body, then at what time?

THE SECRETARY—It is expected that we will go in a body. The train will leave the Union Station (the station

where we arrived), at 12:45 P. M. We will have about an hour at the Fair grounds, and will reach the station on our return a little before three o'clock, at which time the Executive Committee, in accordance with the arrangement of yesterday, have notified Messrs. Pillsbury that we will be at their flour "Mill A," where they have invited us to partake of their hospitality, etc., at three o'clock.

On motion, duly made and seconded, the meeting adjourned till 7:30 P. M.

EVENING SESSION.

The President took the chair at 7:30 P. M.

THE PRESIDENT—The Association will please come to order. The first business, this evening, is the consideration of the invitations, and the decision as to our meeting-place for next year. The several invitations were read just before the adjournment this morning, and if the Association desire, these invitations will be re-read, in order to bring the subject clearly before the Association. The Chair will state for the information of the members, that the Association merely select the place of meeting, and the Executive Committee fix the date.

Or, more correctly, that it is the custom to authorize the Executive Committee to determine the date of the meeting of the Association, the Association merely voting as to the location.

Mr. CRANDELL — Mr. Chairman, I rise to a point of information. I am a new member, comparatively, of this Association, and I have never had a copy of the proceedings or of the by-laws of the Association, until I arrived here. I am informed that one of the articles of the Constitution provides that the time for the meetings of this Association shall be during the month of September, and that under the rules that govern, the Constitution cannot be amended unless one year's notice has been given. If that is the case, I do not presume the members of this Association will desire to

select New Orleans as the place, if it is to be held during the month of September.

THE PRESIDENT—The Secretary is looking up the point, but to the best of my recollection there is nothing in the Constitution or By-Laws that restricts us to the month of September. We met in Cincinnati in October, for instance. It is entirely for the Association to determine, not only the place, but the date of meeting, although it has become a custom—that is, it has been done in the last two or three meetings—to authorize the Executive Committee to determine the date. That point came up in connection with our selecting St. Louis. On account of the regular date at which we had the meeting heretofore, the first or second days in September, bringing us to St. Louis just at the time when the State Fair was held, when the hotels were overcrowded, it would have prevented our getting suitable accommodations.

MR. YOST—Mr. President, does not Article 13 cover this pretty fully? It says, the Association at its annual meeting, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting.

THE PRESIDENT—That is correct, but it is entirely within the power of the Association to relegate that authority to the Executive Committee, and it has been done within the last few years—it has become a custom almost.

MR. CRANDELL—Not to relegate the authority to the Committee to select the place, but to select the date?

THE PRESIDENT—To select the date only; the place has always been selected by the Association itself.

THE SECRETARY—Mr. President, in further explanation, I would say that it has frequently been found rather difficult for the Association a year ahead to select the best date for the time of meeting. Should the Association select the date in advance, some local reasons might arise that would make it better for another week to be selected, even though the month should not be changed. There might be a State Fair, or another Convention, or something that would fill the hotels at the place chosen, and for that

reason it has become customary to relegate the authority to fix the date to the Executive Committee, and, as a matter of fact, the Executive Committee usually adopts the suggestions of the local people at the place where the meeting is to be held. The Association year ends on the 31st of August, and the meeting may be held at any time thereafter, either during September, October or November, or even later. So far as I see, there is nothing in the Constitution or By-Laws to prevent.

THE PRESIDENT—Is it the desire of the Association that the invitations shall be read, or are you ready for a vote? We have two invitations.

THE SECRETARY—Four, Mr. President. The invitations are for Detroit, Buffalo, New Orleans and Old Point Comfort.

MR. EASTABROOK—Mr. Chairman, I move that the roll be called, and that the delegates representing each Company name their choice; failing to get a two-thirds vote according to the Constitution, on the first ballot, that the place having the lowest number of votes be dropped, and so on until a choice is made.

This motion was seconded.

MR. CRANDELL—Mr. President, before the roll is called, I think it would be well enough to hear from the gentlemen who advocate the various places, and let them give the reasons why the Convention should be held there. I do not know that the gentlemen of this Association will select my city, but I certainly think I can myself tell reasons why it should be held there. Perhaps other gentlemen favoring other places can give stronger reasons than I can. I am perfectly willing to hear them. I understand that Mr. Carson, who is anxious for this meeting to be held at Old Point Comfort, has not yet put in an appearance. I want to give him a fair chance, and I would ask that we defer taking a vote on the question until Mr. Carson can be heard on this point. I want everybody to be heard in favor of the places they advocate.

THE PRESIDENT—Detroit, Buffalo and New Orleans can

be heard from, and there are several representatives of the Southern Bell present. Mr. Carson will probably soon be here.

MR. METZGER—Mr. Chairman, I would suggest that we start with Mr. Crandell. I would like to hear Mr. Crandell's reasons why we should go to New Orleans.

THE PRESIDENT—Detroit people are here, and representatives of the Southern Bell are here, although Mr. Carson personally, is not here. I think it will be no injustice to Mr. Carson to listen to the arguments of the gentlemen who desire to have any particular city selected; and if it is the pleasure of the Association, we will hear from Mr. Crandell at once.

MR. EASTABROOK—There is a motion before the house, Mr. President. I think, however, it is perfectly competent for any member to speak to the motion. [Mr. Carson enters the room.]

MR. CRANDELL—Mr. President, Mr. Carson has just come in, and I think we can go on.

THE PRESIDENT—The motion is that the roll be called, and in case of no choice, the place receiving the smallest number of votes shall be dropped, under the constitution.

MR. SMITH—I move as a substitute, that the nominations for the next meeting be now received.

MR. EASTABROOK—I am perfectly willing to accept that, and to say that I believe all the nominations have already been made.

THE PRESIDENT—The nominations have not been made; invitations have been presented only.

MR. EASTABROOK—I am willing to accept that substitute to facilitate matters. That will require another motion. My motion is before this Association, and certainly, if the Chair does not rule otherwise, gentlemen have a right to go on and make their arguments.

MR. SMITH—I will withdraw my substitute.

THE PRESIDENT—The motion before the house is Mr. Eastabrook's resolution.

MR. CRANDELL—I would like to be heard on that before we take a vote.

THE PRESIDENT—It is a debatable question.

MR. CRANDELL—Mr. President and gentlemen of the Convention, as a representative of the Great Southern Telephone & Telegraph Company, which has its headquarters in the great city of New Orleans, inasmuch as you have held this Convention in the extreme northwestern portion of our great nation, we think it is nothing but meet and proper to give the members of this Association residing at the other extreme a chance to extend to you a hearty and cordial welcome; that you come down there and hold your Convention with us. Some years ago that great and good man, Horace Greeley, said to the young men and the people of this country, "Go West." Now, the advice of all men who look into this great country, looking to the advantages of the various sections, all say "Go South," and we are satisfied that if the telephone people will come down to New Orleans and see that country and see our people, and the hospitality that they will extend to them; if they will come down there and see the climate; if they will come down there and see the soil; if they will come down there and see the beautiful women—all I ask is for you to come down there and then judge for yourselves by the hospitality, by the prosperity and progress that that country is now making, and I am satisfied that every member who attends that convention will come away satisfied with his visit there. We will extend to you a most cordial welcome, and the Great Southern Telephone Company will certainly do its part in endeavoring to make you have a good time. I hope you will all vote for New Orleans.

THE PRESIDENT—Are there any further remarks on this question?

There were numerous calls for Mr. Carson.

MR. CARSON—Mr. President, I think I have the sympathies of a number of the gentlemen in the meeting this evening. I am sorry Mr. Crandell spoke before I did, because I cannot begin to make as good a speech.

MR. CRANDELL—You have not got the conditions to sustain it, that is why. You have not got the place.

MR. CARSON—I do not want to say a word to discount New Orleans. What I have to say is, that a meeting of the Association at Old Point Comfort will be unique. The Association began its meetings at a famous watering place, Niagara Falls. Old Point Comfort is one of the famous watering places in this country, and it is a place that everybody ought to go to; he ought to have that experience once in his life, and those who have been there before will be only too glad to go again. As suggested this morning, that place is surrounded by scenes historic during the Civil war, places which every American citizen is glad to have an opportunity to visit. The hotel is one of the finest in the country, and they feel that there are only a few people there when they have three or four hundred in the house. The United States Government has a fort and a force of soldiers there, and there are other points of interest around the place. As far as what may be done by the Southern Bell Telephone Company is concerned—I do not want to go into too minute particulars and details in regard to that. [Laughter.] There is something in the records and in the literature of the country about the hospitality of Old Virginia and I apprehend, gentlemen, if you come down there, that you will agree it is just as true as it ever was, that "Old Virginia never tires." Yes, I think we can show you the birthplace of Pocahontas—at any rate we can show you a place that answers the purposes just as well; and we all know that Captain John Smith rowed up and down the river. I may say this: that you may be sure of a ride up what is called, down in that country, "The Noble Jeems," the James River, through Dutch Gap and all other points of historic interest. Gentlemen, we shall be very glad to welcome you into the territory of the Southern Bell Telephone Company.

MR. FORBES—I am sorry that the senior officer of our company is not here. I remember very distinctly that one of the reasons given why Detroit should not be considered

a year ago was, that the invitation for holding the Convention at Minneapolis was in ahead of ours. Now, our invitation was filed a year ago. Mr. Jackson's letter is simply a renewal of that invitation. We have a very beautiful city, ample hotel facilities, and the meeting in every way will be profitable, I am sure. If you come there, we will agree to make it pleasurable as well, and we will be very glad to have the Association agree on Detroit.

MR. E. J. HALL—I shall take pleasure in having the Association come to Buffalo next year. We had you at Niagara Falls once, but we want you again. We have just finished an elegant new hotel at Buffalo, furnishing the best accommodations to be had anywhere, and we have in switchboards and underground work a very extensive plant, one which is, I think, as modern as any in the country. There you would only be twenty miles from Niagara Falls, and it would be a nice excursion. We should be very glad to have you come there, if the central location and the inducements we can offer will be any inducement to the Association to come. [Applause.]

MR. SISE—Mr. Chairman, I intended to invite the Convention to meet in Canada, but I have just received a protest from the shareholders of several of the companies who say that they object to their managers going to Canada under any circumstances. [Laughter.]

THE PRESIDENT—Are you ready for the question? The motion before the house is the resolution offered by Mr. Eastabrook, that the roll of the Association be called, and each member vote for the place of his choice; that in case of no choice, the place receiving the smallest number of votes be dropped from the list until we arrive at a location.

The motion having been duly seconded, was put and carried.

During the calling of the roll several members took occasion to explain their votes, viz.:

MR. E. J HALL, JR. (representing the American Telephone and Telegraph Co.)—Mr. President, I am sorry to be

on one side of the question and have my father on the other, but there comes a time when the younger generation must break away from the older heads. While, as a director of the Buffalo Company, I should be very glad indeed to have the Convention held there, I think that as a matter of courtesy to Detroit, Buffalo should not push its claim. The location of Detroit is central, and as the invitation has been extended from Detroit several times—it was pressed last year, and the decision then was in favor of Minneapolis—I cast the vote of my Company in favor of Detroit, and more willingly, because I hope that all the delegates in the course of their trip to and from the Convention will stop in Buffalo and allow the Buffalo Company to show their plant and see the first complete metallic circuit exchange in the country. Buffalo is in the position now of taking only metallic circuit subscribers. Everything is being done to make it a complete metallic circuit exchange, and there is no point where I think you could see more of telephonic interest than can be found at Buffalo. It is only one day's ride from Detroit, and I should vote in favor of Detroit, and of putting in the provision that the delegates stop off and pay a visit to our city.

MR. E. J. HALL, SR. (for the Bell Telephone Co., of Buffalo.)—In view of the point which my son has taken and the evidently prior claim of Detroit, I would like, with the permission of the Convention, to withdraw my plea for Buffalo and to vote for Detroit.

MR. BEACH (representing the Central Union Telephone Co.)—I understand that all the meetings of the Telephone Association so far have been held in the North, north of the Ohio River, and I think we ought to go South. Therefore I vote for New Orleans.

MR. GIFFORD (representing the Ohio Valley Telephone Co.)—We are expected to go to Detroit, as I understand, as a matter of courtesy, because it is carrying out the same rule that we acted upon in New York. We voted for Minneapolis last year, while Detroit's invitation was already in, and I think as a matter of courtesy we should next go to

Detroit. But I would like to go to New Orleans and I would like to go to Old Point Comfort, but I am going to vote for Detroit as a matter of obligation, although I would really prefer going to one of the other places.

MR. CARSON—Mr. President, I sympathize with Captain Gifford, and, as a matter of courtesy, as I understand the matter better than I did before, I shall vote for Detroit.

The Secretary announced the result of the roll-call to be 14 for Detroit, 9 for New Orleans and 2 for Old Point Comfort. As the total number of votes cast was 25, the two-thirds required by the Constitution would be 17, and 14 being the largest number cast for any one place, there was no choice.

MR. CRANDELL—Mr. President, in order to expedite matters here, I rise for the purpose of asking for a suspension of the rules and to make Detroit the place for the next meeting of this Association, by acclamation; provided, it is understood, as precedent has established the fact that invitations will be considered in the order of their receipt, that New Orleans one year hence is to have a position ranking the other places that have invitations here, and I give you fair warning that one year from now, when this Association meets, New Orleans is going to carry this Association there for the next meeting, without any opposition. Therefore, I move that Detroit be declared the place for the next meeting, by acclamation.

MR. CARSON—I want to second Mr. Crandell's motion, and I want to say further, that we desire to be counted in, in the matter of courtesy, for the next meeting, or consideration as to the place of the next meeting. I may say further, that Old Point Comfort is not the only place which the Southern Bell Company has to offer. We can invite you to St. Augustine, the oldest town in the United States, with the finest hotel in the world, and there are also other places.

At this point there were calls for the question, which was duly put and it was carried, there being but one No. (Mr. Metzger).

THE PRESIDENT—Unless we have unanimous consent

we will have to have another roll-call. Will Mr. Metzger withdraw his no? Do you want to put us through the trouble of another roll-call?

MR. METZGER—No, I withdraw it.

THE PRESIDENT—The Chair declares the motion unanimously carried, and our next meeting will be held in Detroit. The Secretary will read a letter to the President which has been received.

The Secretary then read the following letter:

September 7, 1889.

PRESIDENT NATIONAL TELEPHONE EXCHANGE ASSOCIATION, Minneapolis, Minn.

Dear Sir:—At the recent convention of the National Electric Light Association at Niagara Falls, a resolution was adopted providing that a committee be appointed to prepare and present to the proper committee of Congress a petition for the abolition of the customs duty on copper, ingot, wire plates, sheets, bars and rods.

The committee appointed under this resolution desires to bring this matter to the attention of your Association, with the view of securing corresponding action by that body, and begs leave to make the following suggestions for your consideration:

First—Copper can be produced in this country cheaper than anywhere else in the world, but it is now, and always has been, higher in price than elsewhere.

Second—The duty on copper brings in almost no revenue to the United States Government, for our copper mines produce more than we use, and we do not ordinarily import copper. The sole effect of the copper tariff, therefore, is to enable the mine owners to advance the price for their own benefit. That they have not been slow to take this advantage which has been offered to them is evidenced by the fact that the American price has been uniformly higher than the English price. It has happened that Lake copper has gone all the way to London, and after being sold there has been retransported to New York, when after paying the duty, it has met in competition copper from the same mine, which has reached the market by the shorter and less expensive route of the Lakes and the Erie Canal.

Third—The use of copper in telephone business is already large and constantly increasing. All underground lines must be of copper, and for overhead lines iron and steel are being less and less used, and copper is required more and more, so that in endeavoring to remove the tax on copper wire, the Telephone Exchange Association will not be endeavoring to do anything impracticable, but will be taking a step towards the advancement of its own interests.

It is respectfully suggested that any action taken by the Telephone Exchange Association should include lead as well as copper. The importance of lead to telephone business is shown by the fact that one manufacturer of cables alone shows the consumption of 175 tons of lead in a single month. There is

a difference in price on this one month's consumption of lead of about $4,000 between the English and the American markets. To show the attitude of the press on this subject, I quote as follows from the New York *Tribune:*

"The demand for the removal of all duties on copper ore, pig and bars, will be difficult to resist. It is safe to say that had the Mills bill proposed no change more unpopular or objectionable than that, its public support would have been incomparably greater."

From the New York *Evening Post:*

"The resolution adopted unanimously by the Electrical Convention at Niagara Falls that the duties on copper ought to be repealed, and the appointment of a committee to prepare and circulate a petition to Congress for that purpose, constitute a very important movement towards the emancipation of industry. Most of the speakers who took part in the debate declared themselves protectionists, but said that the copper tariff was inconsistent with the principles of protection. In this they were right, if it can be said that protection has any principles. There never was any reason for putting a duty on copper or copper ore, except to promote a speculation in mining stocks and to enable the owners of mines to hold the price of American copper at a higher figure than the price of their own copper in foreign markets. Henry Clay and all the fathers of the protective policy in this country would have stood aghast at the idea of putting a duty on an article which we habitually export. The only effect of such a duty is to enable the producers to form a combination against the consumers, and this has been done repeatedly. The last reported combination was formed in Boston last week, and it had the effect to advance the prices of mining stocks very materially both here and abroad. If protection is an object to be sought for, then certainly the greatest good to the greatest number should govern in apportioning its gifts. The number of persons employed in the electrical industries exceeds the number employed in copper mining by ten to one, at a low calculation. Electric power is second only to steam power as a factor in the national wealth and industry, while electric lighting has probably overpassed gas lighting already in the number of lights and the number of hands employed. Copper is the prime raw material of this great and expanding industry. If the electricians will go to work systematically and circulate their petition thoroughly among their producers, employees and customers, they can secure the repeal of the copper tariff this winter. Public opinion, even in protectionist circles, was never much in favor of a duty on copper. Whatever toleration was accorded to it has been mainly demolished by the impudent attempt at Paris to monopolize the world's supply of this article, to which the American producers lent themselves and from which they have reaped enormous profits, although the Paris syndicate came to grief.

The abolition of the customs duty on copper is not a free trade measure in the ordinary sense of the term; it is not a partisan measure, except so far as it represents the interests of the electrical fraternity of the United States and other users of copper. However we look at the tariff question as a whole, however great a benefit we consider it has worked for our manufacturers, not one substantial argument can be advanced in favor of retaining the duty on copper.

Without the duty on copper the mine owners will have the advantages which they now have of mines rich in metal easily produced, and of a market in easy reach. They will have the added advantage of the increased use of their product, which may be expected when the price is reduced to an equality with foreign prices, and when it is put on a stable basis.

It is not easy to estimate how much of an advantage this will be, but from statistics showing how largely copper entered into many kinds of work when the prices were low, and how its consumption was restricted when under the influence of the French syndicate prices were greatly advanced, it will be seen that the advantages of low prices for copper are not altogether on the side of the consumer, but that the mine owner comes in for his share.

No part of the additional price on copper remains permanently in the hands of the drawers of copper wire. The wire drawers are not protected on their product by a heavier duty than is imposed upon copper ingots, and the result of abolishing the duty on copper wire as well as on copper ingots, would be to put the manufacturer of wire in a better position than he occupies at present. With the duty on his raw material removed, there would be the same or a larger margin for him to work on than there is now, with the duty on the raw material and a corresponding duty on his product.

It is urged, therefore, that the National Telephone Exchange Association, at its present Convention, appoint a committee with instructions that will enable it to act in concert with the committee appointed by the National Electric Light Association, with a view to influencing legislation during the coming winter.

Yours truly,

CHAS. A. BROWN,

Chairman of Committee of the National Electric Light Association.

MR. WILSON—I move that the communication be received, and placed on file, and that the President appoint such a committee to co-operate with the Electric Light Committee.

This motion was seconded by Mr. Gifford.

MR. YOST—I move that the resolution be laid upon the table until we get through with other business of the Association.

This motion was seconded.

THE PRESIDENT—A motion to lay on the table is not debatable.

MR. WILSON—Mr. Chairman, I will cheerfully withdraw the resolution until the other business of the Convention is transacted. I will substitute a motion that a paper be received.

MR. YOST—I second this motion.

The question was put and it was carried.

THE PRESIDENT—The Secretary desires to make an announcement before opening the regular order of business.

THE SECRETARY—I would like to announce that almost immediately after the adjournment of the Convention this noon, Mr. McMichael, the Superintendent of the Western Union Telegraph Company in this territory, extended to the members of this Convention the same facilities for telegraphing as have been extended by the Postal Telegraph Company, namely: That all personal messages from members of the Convention will be transmitted free over the lines of the Western Union Telegraph Company, not only from the Minneapolis office, but from the office in St. Paul, to-morrow, from the Ryan House, or any of their offices in St. Paul.

THE PRESIDENT—The Chair will make a further announcement, that, for the excursion to-morrow, cards of invitation have been delivered to-night, either in person or at the rooms of the members.

[Mr. Beach, Vice-President, here took the chair.]

MR. STONE—I would like to ask Mr. McKinstry a question: Would you have any objection to state for the benefit of the gentlemen, who bears the expense of these experiments you have been making in your city, to obviate the induction from the electric roads?

MR. MCKINSTRY—The electric roads.

MR. STONE—I presume we would all be glad to make experiments under the same conditions.

MR. MCKINSTRY—It is possible, if all the members of the Convention had taken the course that I did, they might have arrived at the same results. If you care to hear a few minutes' talk, I will tell what we did when the electric roads were to be introduced. I addressed a letter to each one of the Presidents of the different roads, asking for an interview. I had very good meetings with them, and one in particular stated, from the start, that he was willing to bear the expense of any ordinary change in our wires, to remedy the trouble. They said they would not duplicate our system; that they had heard of the Richmond system, and that they should test it. We made a contract with that company that they

were to furnish an iron or copper wire of No. 4 gauge along the route of their road where our wires passed. They extended the length of the road, and I think the expression was, "A short distance away from the road," that they were to put the wire, and disconnecting our subscriber's wires from the ground, and connecting with this common ground. They were to pay for this copper wire, and the expense was not to exceed $20 for any one subscriber. I guess you will all agree there was no necessity for exceeding that amount. The contract was made and duly executed. We have, I think, quite as complicated a system in Cleveland as our friends mentioned. We have branch exchanges, trunk lines, perhaps a dozen miles of the same wire. I was rather backward about starting in. In fact, I thought, as our friends here do, that the system was not perfect; that it could not be done. I had not sufficient confidence to buy copper wire. Our subscribers were complaining that they would order their telephones taken out, and some were taken out. We had a wire, No. 11 gauge, on Euclid avenue, parallel to the motor. We connected a few wires with very satisfactory results. We increased to 40, all No. 11 wire, running parallel to the track and returned to the exchange and grounded. We had a second wire on the same poles, No. 14 gauge. Our subscribers expressed themselves as entirely satisfied. I do not intend that it shall remain in that shape. We expect to put up proper wire and the railroad people have agreed to pay for it, and have signed a contract to that effect.

THE CHAIR—Unless there are some more points in this matter we had better proceed.

MR. E. J. HALL, JR.—The long distance company has been referred to, I suppose, from the fact that they operate trunk lines, and also metallic circuits. Mr. McCluer shows that he is able to establish a talking circuit by his method between subscribers. There never has been any question in the minds of any one that it was not a practical system by which to establish communication from one subscriber to another. It is quite possible to talk, under some conditions,

taking off the ground entirely and holding one end of the wire in your hand. It is also possible to substitute for the ground a large sized tin pan, the telephone operating through the capacity. There is no question but that Mr. McCluer has helped the service in his exchange, and it might be beneficial wherever it could be applied under similar conditions. I think Mr. Hayes gave an explanation of it in stating that its benefits are due to the fact that the subscribers' wires are open. But when Mr. McCluer suggests theories as to the operation of metallic circuits, we are then in a position to correct some of the impressions conveyed. He suggests, for instance, that the operation of a metallic circuit would be the same whether, having removed the ground all around, you return the two branches of the circuit parallel to each other by the same route, or whether it ran by another route. He said that in his judgment it would work just as well. We know by practical experience, by trying the experiment, that it will not work just as well, and he is entirely incorrect in his theory on that subject. I do not propose to go into any discussion of electric theories, but simply give the result of practice. He also states that the *balance* is of no importance in a metallic circuit; that it is not a question of balance. I want to tell you this, that in operating a metallic circuit between New York and Philadelphia, there being no ground connection, unless the circuit is perfectly balanced, you will have trouble. There will be noises. This is shown particularly at night, when we find that the simple introduction of a single hand telephone, plugged into the metallic circuit at New York, would throw disturbances enough into the telephone at Philadelphia to make it extremely difficult to hear. The only thing done is to disturb the balance of the metallic circuit, and that is only disturbed to the extent of the introduction of one single telephone. That was so serious that we had to substitute for the direct plug in the circuit, the system of bridging. So that he is entirely wrong in his hypothesis that the balance is of no importance. I looked over his diagram with a great deal of interest, and I

think it is applicable in some cases, where it would be found beneficial, but he is also entirely wrong, I think, in stating that it would operate successfully on trunk lines, because he has left out entirely the question of induction between the subscribers' telephones. That is an important matter. In the exchange, with the short circuits and the large number of lines looped together, you do not get induction enough to be of material importance; it is distributed enough to make the circuit operative, but the moment you reduce their number, you bring in the element of induction from one of the trunk lines to another, and have an inoperative trunk line.

THE CHAIR—Gentlemen, the next order of business is a paper on the subject of "Multiple Switchboards," by Mr. Sargent.

MR. E. J. HALL, JR.—I want to introduce a resolution, and I will withdraw it, if it occasions any debate. I want to have it presented while we are all here, and not later in the evening. The Association has been the recipient of many courtesies from our friends here, and we are under obligations to the North-Western Telephone Exchange Company, to the State Agricultural Society of Minnesota, to the Minnesota Brush Electric Light Company, to Messrs. C. A. Pillsbury & Co., to the North American Telegraph and the Postal Telegraph Company, the Western Union Telegraph Company, and many of us, in coming here,—most of us, I think—were very cordially received and entertained in Chicago by the Chicago Telephone Company and the Central Union Telephone Company—and if any of you missed the entertainment there, it was simply because you did not go to Chicago; if you stop there on your way back you will be the recipient of the same hospitality that we received. I move that the Secretary be instructed to send to each of the parties above named, an expression of our appreciation for the kindness which has been extended to us at this meeting.

This motion was duly seconded, put, and carried.

The paper on "Multiple Switchboards" was then read by Mr. W. D. Sargent.

MR. SARGENT—Gentlemen, I have at the beginning of this paper on "Multiple Switchboards" written a few remarks on my experience abroad, which I will read if you will allow me.

REMARKS ON THE TELEPHONE EXHIBIT AT PARIS.

BY W. D. SARGENT.

It was my good fortune to be selected by the American Bell Telephone Co. to take charge of their exhibit at the Exposition Universelle, Paris.

My duties in that connection required me to remain in Paris about two months, during which I spent most of the time at the Exposition, afterwards making a flying trip through Switzerland, Germany, Belgium and England.

The exhibit on the part of the American Bell Company consisted:

First.—Of an historical exhibit, comprising originals and models of the first instruments conceived by Prof. Bell down to the present forms.

Second.—The most improved form of long distance desk transmitters and metallic circuit switchboards, together with samples of cables, call bells and other apparatus, also a large pole, complete with cross-arms, braces, etc., typical of the best form of line construction in this country of the present day. Wires were run from our space in the industrial section of the United States to connect the various offices and departments of the United States Commission. All these wires were run overhead on the buildings and centered in a switchboard, where an operator was stationed to make the necessary connections. This system proved of great service to the commissioners, and was the only active part of our exhibit.

Outside of the telephone exhibit the only electrical exhibits in the United States section were those of the Western Electric Company, embracing general electrical goods; Prof. Elihu Thompson; The Elektron Manufacturing Company; The C. & C. Motor Company; The Okonite Wire Company; The Consolidated Electrical Subway Company, of New York, and the Cobb Wire Company.

Professor Abdank-Abacanowicz was in charge of the United States exhibit, and was particularly efficient in arranging the space and looking after the interests of exhibitors. The rest of the electrical exhibit was in Machinery Hall, being principally in the line of light and power, although there were many forms of burglar alarms, electric bell installations, speaking tube telephones, etc.

Mr. Edison, who occupied the largest space of any single exhibitor, showed all his various inventions with which we are familiar in this country.

The telephone business in Paris, so far as the central office is concerned, is conducted practically the same as in this country, but all their wires, as is well known, are underground, in the extensive sewer system for which the city is noted. This sewer system affords an easy solution of the underground problem, but as it has been described to this Association before, it needs no further description at my hands.

In all the cities where I stopped long enough to make any observations, I found the telephone wires universally overhead, the house-top construction being very much superior to anything we have in this country. The roof fixtures are made of light iron, carrying a very small phosphor bronze wire, so that large masses of wire are scarcely visible, and the fixtures themselves are so light and airy, that to the eyes of a telephone man they are ornamental rather than otherwise.

I did not notice the use of overhead cables to any great extent, except in London, where the telephone system is entirely overhead, and the construction is of much the same character as in other European cities, except that they use overhead cables. In Trafalgar Square a large lead cable is stretched across one side of the square, in full view from all points, and wherever you may look up in the heart of London you will see wires and cables extending in all directions.

The British Postal Telegraph Department put all their wires underground, and as they do a limited amount of telephone business, their telephone wires are underground. Their method has been described before, and consists in drawing gutta percha wires into three and four-inch iron pipes, laid directly under the pavement, just inside the curb, or between the curb and house line, with manholes or handholes at convenient intervals.

I could not learn from any of the electrical people that I met abroad that any plans had been made for a general system for placing a telephone exchange system underground.

Several other members of the Association have been abroad this year, and will doubtless be prepared to give you the benefit of their observations. My own impression is that we have little or nothing to learn abroad, and that it will not be very long before the requirements of the business in London and other large cities will necessitate their placing their wires underground, and that we will be able to teach them many things when that time comes.

MR. SARGENT—For several years I have been reporting to this Association the progress of the underground work in Brooklyn; these papers have been continued this year in the paper already read, from Mr. J. C. Reilly, the General Superintendent of the N. Y. & N. J. Telephone Co., to whom the credit of the very successful work in Brooklyn is in a very large measure due.

A little over a year ago, our largest central office in Brooklyn was equipped with the single cord multiple board, and I have brought here the results of thirteen months' experience with the board, together with tabulated statements and remarks and conclusions by Mr. George J. Davison, Manager of our Brooklyn office, who has made the subject a study, and which I will now proceed to read.

REPORT OF GEORGE J. DAVISON, *Manager Brooklyn Exchange.*

W. D. SARGENT, ESQ., *General Manager,*

Dear Sir—In making a report to you of the workings of our new switch, it might perhaps be well to go back some years and recall the circumstances which led to its adoption.

The exchange was opened in 1879, at No. 4 Court street; removed in 1880 to 397 Fulton street, with 52 subscribers connected, being then operated by the Chinnock system, which was changed in 1882 to the so-called Western Electric standard, section after section of which was added as needed by the increase in subscribers, until at the time of the purchase by this Company, of the property at 16 Smith street, there were in use sixteen 100-wire sections of mixed subscribers and trunk lines, and five sections of purely trunk lines.

The switch, battered and worn, after six years' service, was not adapted for the proper care of so large a number of subscribers as had eventually been connected, nor in keeping with the Company's new building, which was to be fitted up with the best appliances in all respects. The single cord Western Electric Multiple Board was selected, in the belief that it was the best then devised, the most rapid, and the one with which the operators could handle the maximum number of calls.

The switch was ordered in nine sections, of which five were for subscribers' lines, only one subscriber on each line. The trunk lines were in sections by themselves, while the Pay Station lines and the circuit lines (that is, those on which were two or more subscribers), with any others which required special calls, or care in any way outside of the regular order, were also put by themselves. This arrangement of the switch was in accordance with your belief that this was the proper disposition to make of the various circuits, so that the direct or single wire subscriber operators should be entirely free from having to make any connections other than those which were local, and thus be enabled to give more rapid and better service, and also to determine the maximum rapidity of this form of switchboard. The experience gained in the use of this switch has demonstrated the advantages of classifying the business.

One of the Direct Subscribers' sections was equipped with double cords, but with the same looping in and ringing device as on the single cord sections. This modification of the general plan was made because the section so modified was in an angle of the operating room and it was impracticable to put the full complement of single cord equipment in the reduced key-board space, and it was also felt that it would be desirable to have one section of double cords, not only as a relief or emergency section, but also for the purpose of comparison as to the respective merits of the two systems.

During April, May and June 1888, the switch was put into position, all subscribers and trunk lines were connected into it, and everything being in readiness at midnight Saturday, June 30th, 1888, we cut away from our old switchboard and removed into the new quarters.

There were 1,476 wires connected with our switch at the time of removal, besides about one hundred private lines (switch lines, etc.), which come into the distribution room for test or other purposes, making nearly 1,600

wires to be transferred. On Sunday we handled almost the usual volume of Sunday business without serious friction. At morning test on Monday there were but 76 wires which were not in working order, and these were so nearly cleared up during the day that by Tuesday morning our test showed very little over the general average of wires not working.

In accordance with your instructions a record was made up of all troubles arising in the working of the switch at the time of their occurrence, and from these records I have compiled and hand you herewith a tabulated statement showing the number of difficulties arising each month and the particular part of the equipment in which such troubles were developed, and will endeavor to point out the cause and possible remedy for some of them. (See Table No. 1, on page 90.)

As shown by this table, during the thirteen months' use from July 1, 1888, to August 1, 1889, the switch and its equipment have required attention on 1,115 occasions. Of this number, 275 were confined to the cords, the balance of 840 being entirely in connection with what may be termed the fixed mechanical parts of the switch.

These 840 difficulties occurred in the various parts of the equipment as follows:

Spring jacks	11
Drops	294
Combination keys	459
Grounding jacks	76

The trouble in each of these parts has been classified in the accompanying table, so as to show as nearly as possible just where each occurred, and consequently where the principal weakness lies.

SPRING JACKS.—The spring jacks are what is known as the "Boston" type, and there are 15,660 in use, all of which are set horizontally in the switch. The troubles with this part of the switch have been only 11, 10 of which were failures to close the line on the withdrawal of the plug and one a loosened wire where soldered into the jack. The first were readily located and easily remedied, the difficulties being particles of dust or other matter at point of contact, which the insertion of a "jack cleaner" removed. The loosened wire was resoldered with little difficulty. The use of platinum contacts, instead of the present ones of German silver and brass, is the only suggestion of improvement which I can make for the spring jacks. It should not be forgotten that this is the first thirteen months' use of the switch, and that the trouble at this point must be a growing one, and therefore all should be done that is possible to do to guard against it.

DROPS.—The drops used both for subscribers and trunk lines are of the Warner pattern, and 1,660 are in use, 294 having required attention. Over 80 per cent. of all trouble with this part of the apparatus was developed in the first two months the switch was in use. The troubles are classified as follows:

With the catch	26
Shutter	36
Armature trunnion	203
Crossed with core	6
Open in coil	2
Burned out	1
Broken wires	20

TABLE No. 1.

RECORD OF SWITCH TROUBLE AT BROOKLYN, N. Y.—SINGLE CORD WESTERN ELECTRIC MULTIPLE FROM JULY 1, 1888, TO AUGUST 1, 1889.

MONTH.	Spring Jacks. 15,000 in use.			Drops. 1,660 in use.								Combination Keys. 1,560 in use.							Grounding Jacks. 1,440 in use.				Total Troubles in Switch and Key Boards Proper.	Cords.						Grand Total of Troubles of all Kinds.
	Duty Contact.	Unsoldered Wires.	Total.	Catch.	Shutter.	Armature Trunnion.	Crossed with Core.	Open in Coil.	Burned Out.	Broken Wires.	Total.	Operators' Spring on Line.	Angle Piece. Loose.	Cutting out at Main Line Contact.	Operators' Circuit Contact not Closing.	Broken Plunger.	Operator cannot cut out.	Broken Wires.	Total.	Test Crossed with Line.	Operators' Connection Crossed.	Line Spring. Weak.	Operators' Circuit Contact, not closing, Dirty.	Broken Wires.	Total.	Subscribers. 1,260 in use.	Trunk & Double Cord Section. 280 in use.	Operators' "Helpers," 21.	Telephone, 21.	Transmitter, 40.	Total.	
July, 1888	....	..	..	9	15	2	....	....	....	6	32	7	....	....	1	....	....	8	16	3	....	3	....	..	6	54	....	....	..	....	....	....	54
August, "	1	....	1	7	5	190	....	....	....	2	204	3	3	....	3	....	....	3	12	2	2	1	....	1	6	223	....	....	1	2	2	5	228
September, "	1	....	1	2	3	....	1	....	....	4	10	1	....	....	....	....	....	1	2	....	1	....	....	2	3	16	..	6	....	4	....	10	26
October, "	....	....	....	1	2	....	2	....	..	..	5	1	1	..	2	....	....	3	7	1	1	....	....	3	5	17	1	14	2	5	1	23	40
November, "	....	....	....	....	....	1	2	....	....	3	6	2	3	....	3	1	....	4	13	....	....	....	....	6	6	25	2	10	1	4	2	19	44
December, "	1	....	1	1	..	1	..	1	....	1	4	1	....	....	4	1	1	6	13	....	....	....	....	8	13	31	....	10	3	8	1	22	53
January, 1889	1	1	2	2	....	2	1	1	...	2	8	1	....	....	11	....	8	7	27	....	....	....	....	2	10	47	....	15	5	2	....	22	69
February, "	1	....	1	2	3	....	....	....	....	....	5	..	..	....	11	2	11	3	27	....	....	....	....	2	2	35	....	21	3	5	1	30	65
March, "	1	....	1	1	4	....	....	....	....	....	5	1	2	....	5	1	3	1	13	1	....	....	....	1	2	21	1	18	1	4	....	24	45
April, "	2	....	2	....	....	....	....	....	....	....	....	....	....	25	3	1	14	2	45	....	....	....	3	5	8	55	....	9	5	2	....	16	71
May, "	....	....	....	1	1	....	....	....	....	....	2	4	....	59	1	1	51	5	121	....	....	....	....	9	10	134	....	20	9	3	....	32	166
June, "	....	....	....	....	2	....	....	....	....	1	3	1	1	34	....	1	30	9	76	1	....	....	....	3	4	84	....	15	....	2	....	17	101
July, "	2	....	2	....	1	7	....	....	....	1	8	3	....	79	....	....	....	5	87	....	....	....	....	1	1	97	4	32	10	7	2	55	153
Total	10	1	11	26	36	203	6	2	1	20	294	25	10	197	44	8	118	57	459	8	5	17	3	43	76	840	8	170	40	48	9	275	1115

The "catch troubles" were trivial in their nature and easily remedied, requiring no more than a slight bending of the catch in the proper direction. The shutter troubles were caused by the shutter being too flat, so that it rested close against the face of the drop, and hence failed to fall when released by the catch. This failure was due to two causes, that is, air pressure, and the centre of gravity falling directly over, or inside of the hinge. The remedy was bending the shutter outward from the face. A slight modification of the form of the shutter in this respect would be advisable.

The "armature trunnion" troubles were caused by a slight rusting of the iron bearings caused by dampness, and were principally developed in August, 1888, when 190 required attention. The substitution of some metal other than iron at the point of bearing would very greatly reduce this difficulty.

The "crossed with core" caused by abrasion of the insulation. The "open in coil" and "burned out" do not require any special mention, nor do the "broken wires," which were generally the result of lowering the drop shelves for other repairs.

COMBINATION KEYS.—Of the combination keys 1,560 are in use and 459 have required attention. Troubles are classified as follows:

Operators' spring on line,	25
Angle piece loose,	10
Cutting out and failing to close in line circuit,	197
Operator's circuit not closing	44
Rubber plunger broken,	8
Operator "cannot cut out,"	118
Broken wires,	57

"Operators' spring on line" is caused by a loosening of the nut which holds the parts in position, and which could be avoided by slight changes in construction. This is an especially annoying trouble when it occurs at a busy hour, inasmuch as it short circuits the operators' instrument, and all connections for at least 100 subscribers must be made by adjacent operators, by the use of "helpers," and at a serious disadvantage.

"Angle piece loose," refers to the angle piece on the under part of the key and which is a part of the main line circuit. Trouble arises from a loosening of the screw holding it in position.

"Cutting out or failing to close main line contact," has reference to trouble at point of contact between the angle piece just mentioned and the main part of the key. This is the most serious of any of the troubles which have arisen in any part of the switch. None of it appeared for the first nine months, while in the last four months 197 keys had to be attended to,—an average of fifty per month. The trouble so far has been almost entirely confined to the trunk line and double cord section keys, these being used more frequently than a subscriber's key, but there can be no doubt that it is only a matter of time when it will spread throughout the entire key-board. The contact where trouble occurs is only a pressure contact, and between German silver and brass. The brass is in the form of a small rounded

knob, which becomes covered with a black deposit, either from corrosion, dust or other cause. This does not entirely open the line (the generator current never failing to pass through it), but it forms almost a complete barrier to the passage of the telephonic current. An especially bad feature of this trouble is, that it is not necessarily apparent to the operator, who when she cuts in hears the subscriber through another connection, and while she remains in on the connection (in all probability with her hand on the key adding additional pressure and firmly making the contact), the subscribers may talk without any trouble. She no sooner cuts out, however, than the trouble begins. The voices die away, the subscriber rings, the generator current passes the obstructed point, and for a moment or so conversation goes on, only to be again interrupted as the operator jars the key-board by manipulation of adjacent keys. The trouble can be reached only by raising the strip of keys out of the key-board, taking the one in trouble entirely apart and polishing the points, or more correctly the parts, where the trouble is. Of the difficulty in doing this I shall speak more hereafter. The trouble would, I think, be greatly lessened by the use of platinum contacts, but the conformation at this point is especially bad, and I do not believe that any substitution of metals, while retaining the present shape, would entirely remedy the evil. The contact is not a sufficiently positive one; it is at best dependent entirely on the tension of the spring of the key proper, and is liable to be interfered with at all times by the operators' hands and arms as they work.

"Operators' circuit not closing." This trouble arises from dust accumulation, and is easily remedied, except so far as the raising of the key strips is concerned.

"Operators cannot cut out." In these cases the iron rod of the plunger becomes completely or partially stuck so that the operator cannot manipulate it. Remedy, a touch of oil or filing. The broken wires in the case of the combination key, as in all the others, is due almost entirely to breakage while making repairs.

"Grounding Jacks." There are 1,440 of these in use, 76 of which required attention. The troubles arising were:

Test crossed with line	8
Operators' connection crossed	5
Line spring weak	17
Operators' connection not closing, dirt accumulation	3
Broken wires	43

The first three classes were all due to one cause, namely,—the loosening of the screw at the base of the line spring, which allowed one or other of the parts to get out of position, thus causing trouble. These screws are short and screw into hard rubber, and an effort to set them firmly, is likely to result in the stripping of the thread and leaving matters worse than before. The line and test springs, too, do not fit into the rubber as closely as they should, which would

otherwise prevent their getting out of position even though the screw was loosened.

"Operators' connection not closing on account of dust" was easily cleared.

"Broken wire" due to cause heretofore noted.

CORDS.—There are 1,480 cords in use, of which 280 are on trunk and double cord sections. Of the subscribers' cords, but 8 have failed, while of the trunk and double cord sections 170 had to be repaired. The explanation of this great difference in favor of the subscriber's cords, is, that a subscriber's cord is used only to complete those connections for which he may call, while on a trunk or double cord section each cord may be used any number of times.

One of the "operators' helpers cords" is furnished each operator, for the purpose of answering a subscriber, instead of doing so in a regular way; like the trunk and double section cords they show the effect of frequent use.

The failure in all of these was just at the base of the plug, and was due almost entirely to wear and tear, it being hastened, however, in a good many cases, particularly in the "helper" cords, by the rusting of the iron wire, caused presumably by the moisture of the operators' hands penetrating the cotton covering.

The failure in the telephone cords was always at the point of connection with the tip.

The failure of the transmitter cords was due, I think, almost entirely to their passage through the pulleys of their supports.

The transmitters in use are the "skeleton," with counterpoise weights in the rear of the switch. While these transmitters are more liable to get out of order than when enclosed, they are also more easily adjusted, and, being smaller, the view of the switch is less obstructed, and they can be put out of the way when not in use, and, on the whole, are preferable.

The sections of our switch are 6′ 3″ in width, with an actual key-board space of 70x9 inches. Within this space, on subscribers' sections, are placed 300 combination keys and 300 grounding jacks, through each of which a weighted cord is passed. On each combination key and grounding jack are soldered three wires, making in all 1,800 wires under the keyboard of each section. To make repairs to the grounding jacks is not an easy task, but when it becomes necessary to take a combination key apart to clean it, it is a serious matter.

To do this, the strip of twenty keys, of which the troubled one is a part, must be lifted completely out of the key-board, which is particularly difficult on account of the necessarily short forming of the wire cables. After repairing and replacing the keys, it will not infrequently be found that one or more of the wires have been broken, and which it may require half an hour's struggle to replace. In the re-soldering of such broken wires it is almost an impossibility to so dispose of the wires and cords as to permit the insertion of the hot iron without at least scorching some of the cotton insulation. That such breakages, scorchings, etc., will eventually produce a bad state of affairs, is readily apparent.

Among the advantages of the single cord system are the fewer motions

necessary, and the consequent speed with which a call may be secured and completed; the 50 per cent. reduction in the number of cords necessary to complete a given number of connections, and the calling subscribers' drop being left in circuit, makes the "ringing off" as prominent as a "call," and the operator's attention is not divided between two sets of drops.

I think each operator on the single cord system should be furnished with a few pairs of double cords. With these she could complete connections for operators on either side of her in case of a sudden rush or failure of instruments. She could made connections for those of her own subscribers whose cords were found to be out of order, and in addition use these extras at night, instead of going to the switch where a call is received.

Among the disadvantages of the single cord system are,—the multiplicity of soldered wire connections; the defects pointed out in the key-board, especially in the combination key; the delays and annoyances to operators and subscribers in making repairs to key-board; the necessity of the calling subscriber remaining with his receiver to his ear until the desired connection is had or the operator's report received (there being no facilities provided for ringing back to the calling subscriber); and because all calls must be answered and the connections completed at the section of the switch where they originate. This objection becomes a serious one when there is trouble on any operator's instrument connections in the key-board.

The smallest number of subscribers that it is possible for us to put on any operator's instrument is one hundred. Trouble arising with an instrument, the operators on either side must attend to this operator's work, which can only be done by answering with their "helpers," and after testing in the same way, completing the connection with the calling subscribers' cord, a slow, inconvenient and embarrassing method.

The advantages of a double over a single cord system are apparent at such times, and are equally so on Sundays, holidays, evenings and slack times generally, because an operator with the double cord may answer any call and complete the connection from any point at which she may happen to be, and also for the reason that the operator is not dependent on any one cord with which to make a connection, but may substitute another at any moment.

The last objection I shall name, but which perhaps is one of the most serious, is that the single cord system is not conformable to a purely metallic, nor to a mixed metallic and grounded circuit system, because of the impracticability of closing both sides of the metallic circuit when the plug is at rest on the key-board.

With our old switchboard, Western Electric standard, an operator was assigned to each 100 subscribers; with the new system each operator takes care of 150 subscribers and does the work more easily than before. This is an apparent saving of 33⅓ per cent. in operators. In consequence of the changes which were made in operating the trunk lines, the reduction was not so great as this.

TABLE NO. 2.

RECORD OF TEST CALLS MADE FROM SUBSCRIBERS' TELEPHONES CONNECTED WITH BROOKLYN, N. Y., EXCHANGE AND SOME OF ITS SUB-STATIONS. CALLS MADE AT ALL HOURS OF THE DAY AND NIGHT.

	Style of Switch.	Total No. of Subscribers.	No. of subscribers assigned to each operator	Number of test calls made.	Answers from Central. No. of seconds			Conversation began. No. of seconds			Disconnection. No. of seconds			Forms of replies by operators.			No. repeated or not.		Failed connections.		
					Quickest.	Slowest.	Average.	Quickest.	Slowest.	Average.	Quickest.	Slowest.	Average.	What number ?	Well !	Hello !	No. repeated.	No. not repeated.	Busy.	Don't answer.	Miscellaneous.
Brooklyn.....	Single cord W. E. Mu'l	1532	150	348	5	44	3.307	13	70	31.095	12	70	17.184	341	1	6	343	5	3	62	1
Williamsburg...	W. E. Standard	1084	100	279	4	70	8.093	13	240	52.800	11	180	21.338	277	...	2	273	6	2	39	1
Bedford.....	" "	434	100	314	4	180	9.086	18	120	36.800	9	30	19.140	304	...	10	305	9	3	59	...
Greenpoint	" "	264	75	358	5	60	8.469	12	70	32.725	11	600	22.640	253	1	4	347	11	3	71	...
South.....	" "	143	75	235	4	20	7.995	18	60	38.687	11	33	20.077	230	1	4	230	5	...	40	...
Total or Average.	....	3457	.....	1534	4	180	8 411	12	240	34.123	9	600	20.057	1505	3	26	1498	36	11	271	2

In order to test the quality of the service rendered with the present system and to compare it with the service rendered at the sub-stations of this exchange, a special inspector was sent out with instructions to make test calls from all parts of the city, at all hours of the day and night, and for all points within the division. The results obtained in something over 1,500 calls are shown in an accompanying table. (See Table No. 2, Page 95). The calls were made by the subscribers themselves, in order to guard against recognition of the Inspector's voice by the operator, and the result obtained is as fair a test of the service as it is possible to get. In explanation of the large percentage of "don't answer" in the "failed" connections, I would say that the Inspector frequently, when calling at night, asked for numbers that were sure to be closed, in order to avoid annoyance to subscribers, the object of the calls being to test the promptness with which the operators responded at such times.

The compilation does not show results very greatly in favor of the multiple system, except in the greater number of subscribers assigned to each operator.

Our operators are instructed when answering a call to use the words,—"what number," and to repeat the number so that the subscriber may know that the call has been correctly received, and when ringing direct wire subscribers, to give three distinct rings. The latter rule was made to guard, as much as possible, against subscribers being needlessly called to their telephones by ringing off, crosses, or other irregular ringing of their bells.

Respectfully submitted,

GEORGE J. DAVISON,
Manager.

MR. HIBBARD—I move that a vote of thanks be passed for the paper, and that it be printed with the regular proceedings.

This motion was duly seconded, put, and carried.

THE CHAIR—The next matter in order is the statistical report for the year by the Secretary.

THE SECRETARY—Mr. President, the statistical report is here in printed form, and, as it is growing late, I would ask leave to submit it in that form without reading it. If acceptable to the Association, copies can be distributed among the members here.

MR. METZGER—I have no objection to that. I will make that motion, then, in accordance with the views of the Secretary.

Multiple	2,000	977	945	72	974	4	14,040
"	1,700	2,240	1,414	368	1,700	20	24,181
Both	765	771	487	40	421	3	9,180
Multiple	5,460	3,840	3,118	116	3,951	2 3	42,067
Both	4,125	3,054	2,276	80	3,850	297	13,589
Multiple	3,000	1,760	1,322	14	1,907	.....	6,412
"	5,000	3,840	2,708	104	2,918 2	202	45,000
"	2,000	2,347	2,172	62	2,317	76	22,007
"	3,140	1,204	1,050	30	1,060	.....	.....
Multiple	1,000	710	650	10	660	.....	4,784
Multiple	1,000	654	627	18	618	.....	5,702
Straight	800	640	640	...	640	.....	4,647
Both	4,340	3,172	2,192	72	2,914	76	29,252
Multiple	900	677	576	14	666	10	5,072
"	1,200	1,177	1,050	36	1,050	.....	7,864
"	3,000	961	862	16	862	.....	7,200
Straight	1,125	765	765	24	765	80	8,470
"	700	612	607	8	608	.....	.....
Multiple	1,100	1,092	990	42	1,040	.....	4,200
"	4,000	2,760	2,254	120	1,750	11	20,000
"	1,200	1,320	1,242	108	1,264	.....	.....
"	1,800	1,331	1,250	108	1,250	10	10,202
Straight	1,000	891	840	42	840	8	8,970
Straight	1,100	1,161	964	270	814	24	4,744
"	1,200	1,145	972	80	1,052	.....	1,760
Both	2,000	2,860	2,860	1	2,860	638	61,744
Multiple	1,000	1,342	1,120	2	1,140	.....	12,622
Straight	840	696	672	168	672	15	5,867
Straight	600	720	576	48	576	18	.....
"	600	720	576	1	720	.....	5,716
Double	2,100	2,240	2,240	127	2,240	81	31,271
"	2,100	2,268	2,268	252	2,268	1 4	10,000
Straight	300	300	300	90	271	5	4,000
Multiple	2,100	960	960	6	960	8	2,700
"	1,100	2,111	1,584	174	1,584	48	10,027
Straight	840	756	756	107	756	1	15,184
Multiple	1,200	1,008	840	50	840	.....	7,200
"	2,000	840	840	50	840	.....	6,000
Straight	900	1,008	882	126	882	.....	7,005
Multiple	800	840	672	7	672	.....	6,000
Double	2,000	3,024	2,268	121	2,268	60	5,000
Straight	850	560	504	2	567	.....	4,005
Multiple	700	630	504	126	504	16	2,750
"	1,000	1,012	972	18	996	.....	11,712
"	600	600	480	5	582	.....	2,400
"	2,000	1,134	1,008	176	941	18	8,582
Straight	600	840	588	11	804	8	5,027
Multiple	340	564	64	252	572	18	3,000

The motion was duly seconded, put to vote, and adopted. The report is, therefore, printed as follows:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office,
NEW YORK CITY, September 3, 1889.

To the President and Members of the Association:

GENTLEMEN—The By-Laws of our Association which define the duties of the Secretary, prescribe as one of them the preparation of an Annual Report upon "Exchange Statistics." In accordance with such requirement, I have the honor to present the following report for the present year.

On the 19th of June last I addressed to all the companies forming the active membership of the Association, the following circular, viz:

"NEW YORK, June 19, 1889.

"CIRCULAR:

"The work of preparing for the Annual Meeting of this Association, the Report formerly furnished by the Committee on Exchange Statistics, now devolves upon the Secretary. This report, covering as it does the important features in the operation of every exchange, has become more valuable each year for the purpose of comparison, and will farther increase in value and interest if the full co-operation of all the exchanges can be obtained in this work.

"It is requested that the blanks opposite the questions, to be found on the inside pages of this circular, be filled up, and the report returned to this office by July 15th next, in order to give sufficient time for work of compiling statistics. For the sake of uniformity it is suggested that the information as to number of daily connections, etc., be procured on the 27th, 28th and 29th of this month.

"The circumstances surrounding the operation of small exchanges differ so greatly as to afford no common basis of comparison, which is the object to be attained, therefore no reports need be made from exchanges having less than 500 subscribers.

"Any additional blanks required, or explanation of the questions asked, will be cheerfully furnished.

"C. H. BARNEY.

"*Secretary.*"

Pursuant to this request, reports have been received from 48 exchanges, representing 72,474 subscribers. These reports have been made from 24 companies, the remainder either having no exchanges of 500 subscribers or not reporting at all.

The first return was received from the City & Suburban Telegraph Association, of Cincinnati, Ohio, on the 12th of July, and the last one was received on the 2d of the present month.

As has been the practice for several years past, the results deduced from these reports will be presented in a series of comparative tables.

Table No. 1 shows the population of the cities in which the several exchanges are located, the number of subscribers, the increase since last year, and the present ratio of subscribers to inhabitants.

TABLE NO. 1.

EXCHANGE SUBSCRIBERS.

Cities.	Population.	Subscribers in 1889.	Increase over 1888.	Present Ratio, 1 to every	Subscribers in 1888.	Subscribers in 1887.	Subscribers in 1886.	Subscribers in 1885.	Subscribers in 1884.	Subscribers in 1883.	Subscribers in 1882.
Atlanta, 1889.....	74,676	977	17	76	960	862	...	....	...	....	....
Baltimore, 1885....	417,220	2270	9	183	2261	2105	1863	1630	1450	1220	1017
Bay City	39,892	511	....	78	...	....	....	....	....	....	....
Boston, 1885	390,393	3386	1098	115	2288	2130	1847	1696	....	....	....
Brooklyn, 1889... .	800,000	3624	55	220	3569	3297	2797	2354	1846	1601	801
Buffalo..... ...	155,000	1826	29	84	1797	1767	1702	1533	1420	1208	1047
Cincinnati	255,189	3380	324	75	3056	2900	....	....	....	....	....
Cleveland, 1888	254,286	2387	....	106	....	....	....	....	....	....	....
Columbus, 1889	90,000	1204	79	74	1125	....	....	....	....	....	....
Davenport.....	42,135	710	13	59	697	....	....	....	....	....	....
Dayton	38,688	684	74	56	610	....	....	....	....	....	....
*Des Moines, 1889 .	35,000	640	86	54	726	....	....	...	....	....	....
Detroit, 1889	270,492	3112	259	86	2853	2585	2285	1956	1700	1474	....
East Saginaw.....	56,000	677	45	82	632	563	517	....	....		...
Grand Rapids.....	32,380	1177	160	27	1017	872	578	....	...	....	...
Indianapolis, 1887..	125,000	961	....	130	....	....	....	....	....	....	...
Jersey City	161,093	892	27	181	865	769	693	648	391	346	....
Lincoln, 1886.....	29,000	612	....	47	....	....	....	....	....	....	....
Los Angeles, 1889..	80,000	1085	67	73	1018	....	....	....	....	....	....
Louisville	155,910	2003	127	77	1876	1661	1436	1271	....	....	....
Milwaukee, 1889 ...	212,000	2080	172	101	1908	1732	1516	1375	1163	960	....
Minneapolis, 1885..	129,200	1557	....	83	....	1387	....	....	....	....	....
Newark, 1885.....	152,899	951	44	161	907	732	....	....	....	....	....
†New Haven	69,032	1161	51	59	1212	1227	...	....	...	....	....
‡New Orleans	216,140	1145	13	188	1158	1148	1100	1163	....	....	....
New York..... .	1,206,299	7866	566	153	7300	6881	6043	5252	4808	4158	3451
Omaha, 1888	120,000	1432	266	83	1166	....	....	....	....	....	....
Paterson	55,000	558	17	98	541	642	640	651	551	473	....
Pawtucket.....	30,000	561	40	53	521	...	....	...	....	....	...
Peoria, 1888	38,000	594	....	64	....	....	....	....	....	....	....
Philadelphia.....	847,170	2740	176	309	2564	2420	....	....	....	....	....
Pittsburgh..... .. .	254,898	2966	348	86	2618	2286	1951	1688	....	....	....
Portland, Maine....	33,810	800	40	42	760	735	733	....	....	....	....
Portland, Oregon...	20,000	660	130	30	530	....	....	....	....	..	....
Providence.....	120,000	2441	161	49	2280	2417	3168	2802	1892	1745	....
§Reading	43,280	528	4	81	532	503	563	557	...	...	....
Richmond	63,600	768	93	82	675	593	506	427	354	347	....
Rochester	89,500	840	....	106	....	....	....	....	....	....	....
St. Paul, 1885.....	119,000	1263	....	94	....	1025	....	....	....	....	....
St. Joseph	40,000	690	54	58	636	....	....	....	....	....	....
San Francisco.....	300,000	3044	312	99	2732	....	....	....	....	....	....
Springfield, Ill.,1888	29,000	560	6	52	554	....	....	....	....	....	....
Springfield, Mass...	33,340	649	43	51	606	565	535	....	....	....	....
Toledo.....	50,137	1017	28	49	989	...	....	....	...	....	....
Topeka	50,000	500	....	100	...	....	....	....	....	...	....
Washington	250,000	1491	....	168	....	1362	1272	1183	872	....	....
Wilmington	50,000	640	62	78	578	500	440	....	....	....	....
Worcester	68,838	854	66	81	788	718	645	777	...	....	....

*Des Moines, decrease, 86.
†New Haven, decrease, 51.
‡New Orleans, decrease, 13.
§Reading, decrease, 4.

Thirty-eight exchanges in above list reporting last year and this, had in 1888, 56,905 subscribers.

This year they report 61,758 subscribers—a net gain of 4,853, or about 8½ per cent.

Boston has made the greatest gain—1,098, or 48 per cent.

New York has gained 566; Pittsburgh, 348; Cincinnati, 324, and San Francisco, 312.

In the development of territory Grand Rapids still leads with a ratio of one subscriber to every 27 inhabitants.

Portland, Oregon, makes nearly as good a showing, with one to every 30.

Portland, Me., at the other extremity of the country, has one subscriber to every 42 inhabitants.

Of the larger cities, Providence has 1 to 49; Cincinnati, 1 to 75; Louisville, 1 to 77; Minneapolis, 1 to 83; Buffalo, 1 to 84; Detroit, 1 to 86; St. Paul, 1 to 94, and San Francisco, 1 to 99.

Of those cities where the telephone is not in such general use, may be noted Philadelphia, which has only (1) one telephone to every 309 of its inhabitants; Brooklyn, 1 to 220; New Orleans, 1 to 188.

The next table exhibits the average number of daily connections. The business of forty-eight offices is given and that of thirty-eight compared with last year.

TABLE NO. 2.

DAILY CONNECTIONS.

	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	.....	7,421	6,080	.....	.....	.....	.....	.....	.....
Atlanta	14,000	10,175	8,517	...	.....	.....	.....	.....	.....
Baltimore	24,331	18,132	19,275	12,500	10,481	.....	.....	.....	.....
Bay City	6,150	.....	.....	.....	.....	.....	.....	.....	.....
Boston	42,607	1,400	17,345	12,043	10,385	.....	4,741	.....	.....
Brooklyn	19,965	18,821	17,508	14,675	10,809	5,508	5,290	.....	.....
Bridgeport	.....	3,509	.....	.....	.....	.....	.....	.....	.....
Buffalo	6,412	7,938	7,060	6,485	5,980	5,480	22,000	3,842	2,304
Chicago	.....	.....	44,292	32,996	31,368	27,101	.....	16,044	16,136
Cincinnati	45,000	45,000	45,000	.....	.....	.....	4,179	.....	.....
Cleveland	22,067	.....	.....	.....	.....	.....	.....	.....	.....
Columbus	8,530	9,600	.....	.....	.....	.....	.....	.....	.....
Davenport	4,783	4,650	.....	.....	.....	.....	.....	.....	.....
Dayton	5,707	4,604	.....	.....	.....	.....	.....	.....	.....
Denver	.....	5,938	5,230	4,528	4,467	5,298	.....	3,450	.....
Des Moines	4,947	5,778	.....	.....	.....	.....	.....	.....	.....
Detroit	39,428	32,507	33,146	31,723	20,800	.....	.....	.....	.....
East Saginaw	5,992	5,653	7,330	.....	.....	.....	.....	.. ..	.....
Grand Rapids	9,845	7,497	6,800	. ....	.....	.....	.....	.....	.....
Hartford	.....	4,006	3,692	.....	.. ...	.. ...	.....	.....	.....
Indianapolis	7,500	.....	.....	.....	.....	.....	.....	.....	.....
Jersey City	3,870	6,600	4,222	4,000	.....	.....	.....	.....	.....
Lincoln	3,665	.....	.....	.....	.....	.....	.....	.....	.....
Louisville	20,000	16,500	13,200	12,000	.....	.....	.....	.....	.....
Lowell	.....	3,000	2,640	2,265	.....	.....	.....	.....	.....
Los Angeles	4,300	6,000	.....	. ....	.....	.....	.....	.....	.....

DAILY CONNECTIONS—*Continued.*

	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Milwaukee	12,326	9,843	6,548	6,031	4,461				
Minneapolis	10,702		16,000						
Newark	3,959	3,996	2,705						
New Haven	4,584	5,500	6,253						
New Orleans	9,650	9,554	8,002	7,381	6,791				
New York	61,684	64,352	84,750	42,003	36,153	25,912	25,891	19,727	
Omaha	12,622	8,999							
Paterson	2,587	3,020	2,383	2,800					
Pawtucket	4,010	5,880							
Peoria	5,746	7,234							
Philadelphia	20,371	17,905	17,098						
Pittsburgh	16,586	16,000	18,492	14,435	11,583				
Portland, Me	4,000	4,600	3,354						
Portland, Or	2,700	2,000							
Providence	16,027	13,229	12,140	14,423	12,046				
Reading	2,850	3,268	2,239	2,500					
Richmond	13,183		7,651	4,307	4,072	3,013			
Rochester	3,709								
St. Paul	7,005		9,000						
St. Joseph	6,000	7,563							
San Francisco	5,000	5,000							
Scranton		3,219	3,238						
Springfield, Ill.	4,955	4,472							
Springf'd, Mass	2,739	2,783	2,471						
Syracuse		7,158							
Toledo	11,712	7,658							
Topeka	2,400								
Utica		2,731							
Washington	8,592	7,597	6,219	6,705	3,939	2,782			
Wilkesbarre		2,900	3,274						
Williamsport		2,608	2,600						
Wilmington	5,637	5,290	4,756						
Worcester	3,600	3,475	2,150	2,450					

Taking the thirty-eight exchanges which reported last year and this, it will be seen that the daily connections have slightly decreased from 448,695 in 1888 to 445,047.

New York and Baltimore both show a falling off in the number of daily connections, although both have increased the number of their subscribers.

On the whole, the number of daily connections runs very nearly the same as last year.

Table No. 3 shows the average daily calls per subscriber, the daily use of the telephone by each being, of course, double the number of calls as given in the table.

TABLE NO. 3.

CALLS PER SUBSCRIBER.

Exchanges.	1889.	1888.	1887.	1886.	1885.	1884.
Albany	.....	4.7	4.8	.....	.....	.....
Atlanta	14.3	10.5	9.8	.....	.....	.....
Baltimore	10.7	12.	9.1	6.7	7.	6.8
Bay City	12.	.....	.....	.....	.....	.....
Boston	12.5	6.	8.1	6.5	6.	.....
Bridgeport	.....	5.7	.....	.....	.....	.....
Brooklyn	5.5	5.3	5.3	5.2	4.5	3.6
Buffalo	3.5	4.4	3.9	3.8	3.9	4.3
Chicago	.....	.....	9.6	8.1	8.6	3.4
Cincinnati	13.3	4.7	15.5	5.8	6.	7.3
Cleveland	9.2	.....	.....	.....	.....	.....
Columbus	7.1	8.5	.....	.....	.....	.....
Denver	.....	6.2	6.2	.....	.....	.....
Detroit	12.6	11.3	12.8	13.8	10.6	.....
Davenport	6.7	6.7	.....	.....	.....	.....
Dayton	8.3	7.5	.....	.....	.....	.....
Des Moines	7.7	5.3	.....	.....	.....	.....
East Saginaw	8.8	8.9	13.	.....	.....	.....
Grand Rapids	8.3	7.3	7.8	.....	.....	.....
Hartford	.....	4.6	4.5	.....	.....	.....
Indianapolis	7.8	.....	.....	.....	.....	.....
Jersey City	4.3	7.6	5.4	5.7	.....	.....
Lincoln	5.9	.....	.....	.....	.....	.....
Lowell	.....	4.5	4.1	3.8	.....	.....
Los Angeles	3.9	5.8	.....	.....	.....	.....
Louisville	10.	8.7	7.9	8.3	.....	.....
Milwaukee	5.9	5.1	3.7	3.9	3.2	.....
Minneapolis	6.8	.....	11.5	.....	.....	.....
Newark	4.2	4.2	3.6	.....	.....	.....
New Haven	3.9	4.5	5.	.....	.....	.....
New Orleans	8.3	8.2	6.9	6.6	5.9	.....
New York	7.8	8.8	12.3	6.5	7.	5.1
Omaha	8.8	7.7	.....	.....	.....	.....
Paterson	4.6	5.5	3.7	4.3	.....	.....
Pawtucket	7.1	11.2	.....	.....	.....	.....
Peoria	9.6	.....	.....	.....	.....	.....
Philadelphia	7.4	6.5	7.1	.....	.....	.....
Pittsburgh	5.6	6.1	8.1	7.3	6.8	.....
Portland, Maine	5.	5.9	4.5	.....	.....	.....
Portland, Oregon	4.1	3.6	.....	.....	.....	.....
Providence	6.6	6.5	5.	4.5	5.2	5.
Reading	5.4	6.	4.4	4.4	.....	.....
Richmond	17.1	.....	12.9	8.5	9.5	8.8
Rochester	4.4	.....	.....	.....	.....	.....
St. Paul	5.5	.....	8.7	.....	.....	.....
St. Joseph	8.7	11.8	.....	.....	.....	.....
Scranton	.....	4.7	5.2	.....	.....	.....
Springfield, Mass	4.2	4.5	4.3	.....	.....	.....
Syracuse	.....	8.8	.....	.....	.....	.....
San Francisco	1.6	1.8	.....	.....	.....	.....
Springfield, Ill	8.8	7.1	.....	.....	.....	.....

CALLS PER SUBSCRIBER—*Continued.*

Exchanges.	1889.	1888.	1887.	1886.	1885.	1884.
Toledo	11.5	7.7				
Topeka	4.8					
Utica		4.2				
Washington	5.9	1.8	4.5	5.2	3.5	
Wilkesbarre		4.8	6.2			
Williamsport		4.	5.5			
Wilmington	8.8	9.	9.5			
Worcester	4.2	4.4	3.4	3.7		

Forty-eight exchanges have reported, of which thirty-eight can be compared with last year. In 1888 Baltimore showed the greatest appreciation of the telephone, judging from the amount of use to which it was put in that city, the average of daily calls per subscriber being 12. This year it is reported as 10.7.

Richmond shows the highest average in 1889—17.1—followed by Atlanta with 14.3; Cincinnati, 13.3; Detroit, 12.6; Boston, 12.5, and Bay City with 12 calls per subscriber.

The lowest average is reported by San Francisco, being only 1.6.

No other exchange shows a lower average than 3.5.

Of the thirty-eight exchanges reporting this year and last eighteen show an increase in the average number of calls; the same number report a decrease, while two, Davenport and Newark, are the same as in 1888.

Table No, 4 shows the number of lost or delayed connections, from such causes as "busy," "don't answer," and "in trouble;" thirty-seven exchanges have reported, and twenty-seven can be compared with last year.

TABLE NO. 4.

LOST OR DELAYED CONNECTIONS.

Exchanges.	1889.		1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Albany			368	4.9	465	7.6						
Atlanta	409	2.9	350	3.4	200	2.3						
Baltimore	3062	12.5	1224	2.5	1224	6.3	900	7.2	900	9.	800	8.
Bay City	741	12.										
Boston	538	1.2	38	2.			1021	8.5	618	5.		
Brooklyn	860	4.3	1375	7.5	1363	7.8	817	5.6	506	5.	634	11.
Buffalo	402	6.3	755	9.5	527	7.5	421	6.5	446	7.	520	9.
Chicago					4326	9.8	3852	17.	2759	8.7	1355	5.
Cincinnati	750	1.6	700	1.5	500	1.1						
Cleveland	2630	11.9										
Davenport			173	3.7								
Dayton	275	4.8	3	6.5								
Denver					208	4.	186	4.1		.6		
Des Moines			300	5.2								
Detroit	1420	3.6	2808	8.6	3209	9.7	2100	6.6	2120	10.		
East Saginaw	425	7.1	420	7.4	443	6.	263					
Grand Rapids	862	8.7	657	8.7	645	9.5	617					
Hartford					100	2.7						
Indianapolis	780	10.4										

LOST OR DELAYED CONNECTIONS—*Continued.*

Exchanges.	1889.		1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per Cent.	No. Daily.	Per Cent	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Jersey City	354	9.1	174	2.6	269	6.4	200	5.	....		....	....
Louisville, est'd	3000	15.0	128	10.	est'd	10.	est'd	10.	....	....	....	....
Lowell	....	....	300	10.	75	2.8	195	8.6	....	....	....	....
Los Angeles	62	1.4	....	....	....	....	....	....	....	....	....	....
Milwaukee	30	0.2	42	4.2	994	15.2	2052	34.	892	20.	....	....
Minneapolis	1302	12.1	....	....	1600	10.	....	....	....	....	....	....
Newark	250	6.3	20	0.55	40	1.5	....	....	....	....	....	....
New Haven	438	10.6	150	2.7	950	15.2	....	....	....	....	....	....
New Orleans	350	3.5	440	4.6	450	5.6	600	8.1	426	6.5	....	....
New York	4648	7.5	1639	2.5	443	.5	2180	5.5	1959	5.	1789	8.
Omaha	....	....	260	2.9	....	....	....	....	....	....	....	....
Peoria	490	8.5	398	5.5	....	....	....	....	....	....	....	....
Paterson	30	1.2	70	2.2	216	9.1	125	4.5	....	....	....	....
Pittsburgh	1544	9.3	1140	7.	1735	9.4	1397	9.7	1085	10.	....	....
Portland, Me	300	7.5	450	....	263	7.8	238	....	....	....	....	....
Portland, Oregon	40	1.5	....	....	....	....	....	....	....	....	....	....
Reading	50	1.7	500	10.5	268	12.0	150	.6	....	....	....	....
Richmond	250	1.8	....	....	....	....	....	....	....	....	....	....
Rochester	91	2.4	....	....	....	....	....	....	....	....	....	....
San Francisco	120	2 4	....	....	....	....	....	....	....	....	....	....
St. Paul	400	5.7	....	....	900	10.	....	....	....	....	....	....
St. Joseph	300	5.	....	....	....	....	....	....	....	....	....	....
Scranton	....	....	289	8.9	171	5.3	195	....	....	....	....	....
Springfield, Ill	125	2.5	1040	23.2	....	....	....	....	....	....	....	....
Springfield, Mass	145	5.2	183	6.5	119	4.8	113	....	....	....	....	....
Toledo	850	7.2	760	9.6	....	....	....	....	....	....	....	....
Utica	....	....	268	9.8	....	....	....	....	....	....	....	....
Washington	757	8.8	634	8.3	576	9.3	738	11.	777	1.9	602	20.
Wilkesbarre	....	....	619	10.6	175	5.3	62	....	....	....	....	....
Williamsport	....	....	266	10.2	250	9.6	158	....	....	....	....	....
Wilmington	....	....	....	....	234	4.9	....	....	....	....	....	....
Worcester	275	7.6	275	7.9	175	7.1	125	5.1	....	....	....	....

Louisville estimates the percentage of lost connections at 15 per cent., which is higher than that reported by any other exchange, the nearest being Baltimore, with 12.5.

Five other exchanges show a percentage of 10 or over, as follows: Minneapolis, 12.1; Bay City, 12; Cleveland, 11.9; New Haven, 10.6, and Indianapolis, 10.4.

Boston and Paterson make the best showing, their percentage of lost connections being 1.2.

Six exchanges report an average of 2 per cent., or lower, as follows: Los Angeles, 1.4; Portland, Oregon, 1.5; Cincinnati, 1.6; Reading, 1.7; Richmond, 1.8, and Milwaukee, 2 per cent.

Table No. 5 shows the average number of connections which each subscriber operator makes daily from 8 A. M. to 6 P. M.

Forty-six exchanges have reported and thirty-four can be compared with 1888.

TABLE No. 5.

DAILY CONNECTIONS PER OPERATOR.

Exchanges.	1889	1888	1887	1886	1885	1884	1883	1882	1881
Albany	....	449	429	...	....	....	....	....	....
Atlanta	812	608	746	....	....	....	....	....	....
Baltimore	874	1132	788	595	390	....	....	....	....
Bay City	570	....	....	....	....	....	....	....	....
Boston	1039	....	788	514	375	....	...	....	....
Brooklyn	376	214	384	367	277	177	132	...	....
Bridgeport	....	394	....	....	....	....	....	....	....
Buffalo	323	276	269	233	233	221	263	148	....
Chicago	...	....	328	300	290	271	202	161	....
Cincinnati	843	650	522	....	....	....	....	....	....
Cleveland	849	....	....	....	....	....	....	....	....
Columbus	710	788	....	....	....	....	....	....	....
Davenport	386	500	....	....	....	....	...	....	....
Dayton	714	685	....	....	....	....	....	....	....
Denver	....	315	319	269	291	360	379	246	....
Detroit	691	676	942	709	710	....	..	....	....
Des Moines	530	428	....	....	....	....	....	....	....
East Saginaw	385	319	732	643	....	...	....	....	....
Grand Rapids	388	485	469	372	....	....	...	....	...
Hartford	....	293	310	....	....	....	....	....	....
Indianapolis	616	....	....	....	....	....	....	....	....
Jersey City	224	265	388	400	...	....	....	....	....
Lincoln	523	....	....	....	....	...	....	....	....
Louisville	816	674	612	633	....	...	....	....	....
Lowell	....	438	440	324	....	....	...	....	...
Los Angeles	530	....	....	....	....	....	....	....	....
Milwaukee	685	468	345	335	251	203	269	....	....
Minneapolis	618	...	960	. ..	....	....	....	....	....
Newark	255	215	116	....	....	....	....	....	...
New Haven	420	308	338	...	....	....	....	....	....
New Orleans	1114	1127	1073	1054	848	...	....	....	....
New York	447	647	895	200	225	145	120	114	....
Omaha	464	649	....	....	....	....	....	...	....
Paterson	468	437	303	400	....	....	....	....	....
Pawtucket	1000	728	....	....	....	...	....	....	....
Peoria	876	541	....	....	...	..	...	....	..
Philadelphia	....	469	465	....	....	....	....	....	....
Pittsburgh	333	330	569	504	526	....	....	...	....
Portland, Me	390	400	305	327	....	....	....	....	....
Portland, Oregon	417	330	....	...	....	....	....	....	....
Providence	727	692	301	280	335	....	....	....	....
Reading	518	453	334	355	....	....	....	....	...
Richmond	1163	....	1028	....	....	....	....	...	....
Rochester	475	....	....	....	....	...	....	....	....
San Francisco	265	....	....	....	....	....	..	....	....
St. Paul	253	....	304	....	....	....	....	....	....
St. Joseph	786	1101	....	....	....	....	....	....	....
Scranton	....	402	405	620	....	....	....	....	....
Springfield, Ill	666	584	....	....	....	....	....	....	....
Springfield, Mass	342	306	305	293	....	...	....	....	....
Syracuse	....	988	....	....	....	....	....	....	....
Toledo	488	765	....	....	....	....	..	....	....
Topeka	480	....	...	....	....	....	....	....	....
Utica	....	390	....	....	....	....	....	...	....
Washington	556	521	530	637	387	....	....	....	....
Wilkesbarre	....	580	444	469	....	...	....	....	....
Williamsport	....	522	325	401	....	....	....	....	....
Wilmington	....	881	910	....	...	....	....	....	....
Worcester	533	326	237	306	. ..	....	....	....	..

From this table it appears that the operators at Richmond do the most work, and those at Jersey City the least, the average at the former exchange being 1,163, and at the latter only 224 *per diem*.

Boston shows an average of 1,039; New Orleans, 1,114, and Pawtucket, 1,000.

In 22 out of the 37 exchanges which can be compared with 1888, the operators are doing more work than last year.

Table No. 6 gives the number of wires which each operator is expected to attend.

TABLE NO. 6.

SUBSCRIBER'S WIRES PER OPERATOR.

Exchanges.	1889.	1888.	1887.	1886.	1885.	1884.	1883.
Albany		83	77				
Atlanta	59	75	85				
Baltimore	65	66	98	67	71	85	30
Bay City	47						
Boston	82	90	95	88	63		
Brooklyn	80	70	74	72	71	68	48
Bridgeport		39					
Buffalo	88	63	62	57	70	67	67
Chicago			34	37	33	34	31
Cincinnati	57	53	37				
Cleveland	87						
Columbus	100	100					
Davenport	63	100					
Dayton	91	100					
Denver		53	52	48			
Des Moines	91	90					
Detroit	54	39	76	71	70		
East Saginaw	55	38	38	55			
Grand Rapids	50	43	60	57			
Hartford		28	33				
Indianopolis	77						
Jersey City	49	46	58	64			
Lincoln	87						
Louisville	86	100	71	70			
Lowell		33	42	37			
Los Angeles	148	150					
Milwaukee	94	78	76	71	91	64	46
Minneapolis	76		62				
Newark	64	54	46				
New Haven	51	30	73				
New Orleans	150	153	157	142	144		
New York	60	79	84	91		66	
Omaha	57	100					
Paterson	93	74	76	75			
Pawtucket	57	26					
Peoria	100	100					
Philadelphia	70	60	56				
Pittsburgh	59	50	65	62	65		
Portland, Me.	36	33	38	37			
Portland, Oregon	108	100					
Providence	56	51	28	35	35		
Reading	64	54	57	44			
Richmond	76	83	84	128	108	88	
Rochester	95						

SUBSCRIBER'S WIRES PER OPERATOR.—*Continued.*

Exchanges.	1889.	1888.	1887.	1886.	1885.	1884.	1883.
San Francisco	140						
St. Paul	33		38				
St. Joseph	100	100					
Scranton		38	32	47			
Springfield, Ill	93	100					
Springfield, Mass	37	31	71	67			
Syracuse		80					
Toledo	66	95					
Topeka	100						
Utica		79					
Washington	80	79	80	79	126		
Wilkesbarre		45	34	53			
Williamsport		53	44	64			
Wilmington	85	89	90	92			
Worcester	63	35	34	34			

Twenty-nine multiple boards average 79 wires to each operator; twelve straight boards average 71 wires per operator.

As was the case in 1887 and 1888, both these averages show an increase over the preceding year.

The average cost of each connection at the different exchanges is shown in Table No. 7.

Forty-one exchanges have reported this year on this point.

TABLE NO. 7.

COST OF CONNECTIONS.

This table is made up from the *operators' pay-roll only*, and does not include the rental of the exchange and other items of operating expense; neither does it take into consideration the cost of repairs and maintenance: *it is simply the labor performed by the operator in connecting two parties together.*

Exchanges.	COST OF ONE CONNECTION.							
	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
Albany		.00227	.0026					
Atlanta	.0032	.0034	.0029	.1				
Baltimore	.0013		.0013	.0045	.0025	.0040	.0058	.0072
Bay City	.0027							
Boston				.0166	.0038			
Brooklyn	.0030	.004	.0041	.0040	.0041	.0069	.0098	
Bridgeport		.007						
Buffalo	.0048	.00518	.0053	.0057	.0064	.0060	.0047	.0072
Chicago			.0040	.0056	.0048	.0054	.0064	.0073
Cleveland	.0025							
Columbus	.0034	.003						
Davenport	.0036							
Dayton	.0038							
Denver		.00531	.0055	.0061				
Des Moines	.0037							
Detroit	.0016	.0017	.0014	.0016	.0021			
East Saginaw	.0035	.0037	.0025	.0020				

COST OF CONNECTIONS.—*Continued.*

Exchanges.	Cost of One Connection.							
	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
Grand Rapids	.0029	003	.0024	.0052				
Hartford		.0091	.0043					
Indianapolis	.0023							
Jersey City	.0045	.0034	.0043	.0050				
Lincoln	.0016							
Louisville	.0021	.0024	.0026	.0033				
Lowell		.006	.0063	.0063				
Los Angeles	.0030							
Milwaukee	.0022	.0026	.0032	.0035	.0046	.0113	.0055	
Minneapolis	.0026		.0016					
Newark	.0053	.0055	.0060					
New Haven	.0055		.0066					
New Orleans	.0021	.001	.0018	.0011	.0015			
New York	.0075	.0042	.0078	.0083	.0066	.0066		
Omaha	.0022	.029						
Paterson	.0060	.0036	.0056	.0050				
Peoria	.0033							
Philadelphia		.005	.0037					
Pittsburgh	.0056	.0041	.0031	.0035	.0051			
Portland, Me	.0066	.0026	.0071	.0078				
Portland, Oregon	.0061	.005						
Reading	.0050	.0048	.0047	.0020				
Richmond	.0024		.0023					
Rochester	.0040							
St Paul	.0050		.0028					
San Francisco	.0145							
St. Joseph	.0020	.0025						
Scranton		.03⅛	.0046	.0034				
Springfield, Ill	.0034	.0025						
Springfield, Mass	.0047	.0044	.0052	.0060				
Syracuse		.0015						
Toledo	.0013	.0035						
Utica		.0052						
Washington	.0026	.003	.0037	.0031	.0051			
Wilkesbarre		.002	.0045	.0028				
Williamsport		.035	.0048	.0034				
Wilmington			.0020	.0026				
Worcester	.0022	.0047	.0089	.0073				

Twelve exchanges, as follows: Des Moines, Jersey City, New Orleans, New York, Paterson, Peoria, Pittsburgh, Portland, Me., Portland, Ore., Reading, Springfield, Ill., and Springfield, Mass., show an increase in cost of connections over 1888.

Baltimore and Toledo report the lowest cost. The average at these exchanges being .0013 per connection, and San Francisco the highest, .0145.

Table No. 8 gives the number of trunk lines. This number shows an increase every year.

Fourteen exchanges show a gain of 188 over last year, while five exchanges report a discontinuance of 93; a net gain of 95.

TABLE No. 8.

NUMBER OF TRUNK LINES.

Exchanges.	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
Albany	.....	24	24	.....	.....	.....	.....	.....
Atlanta	4	3	.....	.....	.....	.....	.....	.....
Baltimore	20	20	18	17	.....	.....	.....	.....
Bay City	9	.....	.....	.....	.....	.....	.....	.....
Boston	253	177	213	183	152	.....	.....	.....
Brooklyn	257	239	221	175	126	104	89	.....
Bridgeport	.....	13	.....	.....	.....	.....	.....	.....
Buffalo	.....	59	57	57	45	37	26	21
Chicago	.....	.....	369	366	355	254	245	228
Cincinnati	262	261	260	.....	.....	.....	.....	.....
Cleveland	75	.....	.....	.....	.....	.....	.....	.....
Davenport	.....	17	.....	.....	.....	.....	.....	.....
Dayton	.....	15	.....	.....	.....	.....	.....	.....
Detroit	57	50	37	30	20	.....	.....	.....
East Saginaw	10	12	10	4	.....	.....	.....	.....
Hartford	.....	18	16	.....	.....	.....	.....	.....
Jersey City	85	84	69	67	.....	.....	.....	.....
Louisville	11	11	12	2	.....	.....	.....	.....
Lowell	.....	12	12	12	.....	.....	.....	.....
Minneapolis	.....	.....	14	.....	.....	.....	.....	.....
Newark	50	41	23	.....	.....	.....	.....	.....
New Haven	28	19	20	.....	.....	.....	.....	.....
New York	669	742	755	600	520	491	331	274
Paterson	15	17	21	26	.....	.....	.....	.....
Pawtucket	19	19	.....	.....	.....	.....	.....	.....
Philadelphia	51	62	60	.....	.....	.....	.....	.....
Pittsburgh	114	82	78	47	39	.....	.....	.....
Portland, Me	5	5	5	6	.....	.....	.....	.....
Portland, Oregon	3	.....	.....	.....	.....	.....	.....	.....
Providence	48	47	39	32	37	42	38	48
Reading	6	5	9	5	.....	.....	.....	.....
Richmond	1	1	.....	.....	.....	.....	.....	.....
St. Paul	.....	.....	16	.....	.....	.....	.....	.....
San Francisco	69	43	.....	.....	.....	.....	.....	.....
Scranton	.....	1	2	2	.....	.....	.....	.....
Springfield, Mass.	16	15	13	12	.....	.....	.....	.....
Utica	.....	16	.....	.....	.....	.....	.....	.....
Washington	18	13	4	5	.....	.....	.....	.....
Wilkesbarre	.....	5	7	7	.....	.....	.....	.....
Williamsport	.....	4	.....	2	2	.....	.....	.....
Wilmington	8	8	6	6	.....	.....	.....	.....
Worcester	18	23	12	8	.....	.....	.....	.....

Table No. 9 presents statistics regarding daily use of trunk lines.

TABLE No. 9.

TRUNK CONNECTIONS.—DAILY CONNECTIONS PER TRUNK.

Exchanges.	1889	1888	1887	1886	1885	1884	1883	1882	1881
Albany	....	10	18	....	....	....	....	....	....
Atlanta	23	30	..	....	....	..	....	...	....
Baltimore	11	13	12	26	....	....	....	....	....
Bay City	43	....	....	....	....	....	....	....	....
Boston	44	...	27	24	....	....	....	....	....
Brooklyn	41	29	22	25	33	28	....	....	....
Buffalo	....	31	26	26	36	39	50	41	21
Chicago	...	....	75	61	56	38	...	....	....
Cincinnati	42	42	38	....	....	....	..	...	....
Cleveland	84	....	....	....	....	....	....	....	....
Detroit	89	44	155	61	52	....	....	....	....
East Saginaw	71	81	....	....	...	....	....	..	...
Jersey City	22	19	13	13	...	....	....	....	....
Louisville	20	50	40	40	....	....	....	....	....
Newark	10	15	16	...	....	....	....	....	....
New Haven	19	11	27	....	....	....	....	....	....
New York	55	32	43	56	48	31	41	31	23
Paterson	13	15	10	10	....	....	....	....	....
Pawtucket	45	....	....	....	....	....	....	....	...
Pittsburgh	53	54	69	74	111	....	....	....	...
Portland, Maine	75	54	8	11	....	....	....	....	....
Portland, Oregon	10	12	....	....	....	....	....	....	....
Providence	15	88	....	....	....	....	....	....	....
Reading	17	2	76	4	....	....	....	....	...
Richmond	25	....	....	....	....	....	...	....	....
San Francisco	35	40	....	....	....	....	....	....	....
Springfield, Mass	16	9	13	9	....	....	....	....	....
Washington	20	78	16	8	....	....	..	....	....
Williamsport	....	25	48	41	....	....	....	....	....
Wilmington	....	38	22	....	....	....	....	....	....
Worcester	7	75	80	...	....	....	....	....	....

Twenty-five exchanges reporting last year showed an average of 36 connections per day on each trunk line; twenty-six exchanges this year report a daily average of 39.

Detroit has the highest average, 89, and Cleveland next, 84.

The lowest average, 7, is reported by Worcester.

Table No. 10 shows the number of "direct" and "circuit" wires at the different exchanges.

TABLE No. 10.

DIRECT AND CIRCUIT WIRES.

Exchanges.	1889.		1888.		1887.		1886.		1885.	
	Direct.	Circuit.	Direct	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.
Albany	.....	....	1,130	65	1,087	60	.....	...	.....	....
Atlanta	942	12	907	13	821	10	..	....	.....	...
Baltimore	1,314	386	1,197	464	1,078	372	1,007	404	831	388
Bay City	431	40	.....	....	.....	...	.....	....	.....	....
Boston	3,115	116	2,223	31	2,056	34	1,769	36	1,606	44
Brooklyn	3,276	80	2,944	195	2,705	170	2,157	195	1,734	237
Bridgeport	.....	....	169	106	.....	....	.....	....	.....	...
Buffalo	1,320	187	1,272	179	1,258	174	1,185	183	1,102	165
Chicago	.....	...	.....	...	4,577	....	4,067	....	3,630	....
Cincinnati	2,509	403	2,351	309	2,222	299	.....	....	.....	....
Cleveland	2,255	62	.....	..	.....	....	.....	....	.....	...
Columbus	1,050	50	1,005	42	.....	....	.....	....	.....	....
Davenport	686	10	655	12	.....	....	.....	...	.....	....
Dayton	627	16	562	12	.....	....	.....	....	.....	....
Denver	.....	....	853	39	740	44	717	9	715	10
Des Moines	640	...	726	....	.....	....	.....	....	.....	156
Detroit	2,492	272	2,282	244	2,060	231	1,821	189	1,605	....
East Saginaw	559	49	479	55	345	153	390	53	.....	....
Grand Rapids	1,013	63	892	41	738	48	638	45	.....	....
Hartford	.....	....	170	200	176	193	.....	....	.....	....
Indianapolis	922	16	.....	....	.. ...	....	.....	....	.....	....
Jersey City	482	203	433	150	442	143	385	131	350	127
Lincoln	607	2	...	....	.....	....	.....	....	.....	....
Louisville	1,257	329	1,077	347	776	434	675	372	730	371
Lowell	.....	....	90	206	82	173	32	227	52	221
Los Angeles	995	45	922	44	.....	....	.....	....	.....	..
Milwaukee	1,525	169	1,435	208	1,311	179	1,172	104	986	112
Minneapolis	1,029	193	.....	....	579	287	.....	....	.....	....
Newark	851	45	858	3	697	2	... ..	....	.....	....
New Haven	264	250	226	274	214	261	.....	....	.....	...
New Orleans	972	80	1,002	73	1,034	47	995	73	97[illegible]	84
New York	7,863	1	7,298	2	6,842	8	6,004	6	5,213	6
Omaha	1,427	2	1,166	....	.....	....	.....	...	.....	....
Paterson	375	90	353	93	433	99	441	92	459	94
Pawtucket	45	182	36	149	.....	....	.....	....	.....	....
Peoria	593	1	539	1	.....	....	.....	....	.....	...
Philadelphia	2,240	127	2,040	130	1,897	132	.....	....	.....	....
Pittsburgh	2,378	222	2,001	229	1,738	210	1,457	205	1,120	173
Portland, Me	96	271	98	267	45	316	37	329	.....	....
Portland, Oregon	640	6	510	4	.....	....	.....	....	.....	....
Providence	404	654	337	646	322	675	340	944	324	616
Reading	167	152	164	160	104	240	145	184	147	233
Richmond	758	5	660	6	580	6	490	9	.....	....
Rochester	567	99	.....	....	.....	....	.....	....	.....	....

DIRECT AND CIRCUIT WIRES.—*Continued.*

Exchanges.	1889.		1888.		1887.		1886.		1885.	
	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.
St. Paul	698	194	.....	....	469	210	.....	....	.....	....
St. Joseph	676	7	623	6	.....	....	.....	....	.....	....
San Francisco	2,808	121	2,075	263	.....	....	.....	....	.....	....
Scranton	.....	....	87	184	84	168	69	164	.....	...
Springfield, Ill	554	3	553	1	.....	..	.....	....	.....	..
Springfield, Mass.	61	196	51	190	41	162	52	145	.....	....
Syracuse	.....	....	541	129	.....	...	.....	...	.....	....
Toledo	977	18	936	17	.....	....	.....	....	.....	...
Topeka	496	3	.....	....	.....	....	.....	....	.....	....
Utica	.....	....	551	36	.....	....	.....	....	.....	....
Washington	466	475	524	331	478	300	444	270	292	314
Wilkesbarre	.....	....	142	83	128	73	119	91	.....	...
Williamsport	.....	.. .	111	154	114	152	105	151	.....	....
Wilmington	553	41	496	36	433	17	372	33	.....	....
Worcester	54	323	72	253	57	215	78	192	88	185

Fifty exchanges in 1888 showed 47,824 direct, and 6,682 circuit wires, while this year forty-eight exchanges report 56,029 direct, and 6,271 circuit wires—showing that the tendency is more and more towards direct wires.

Of the exchanges reporting this year only six, viz: Pawtucket, Portland, Me. Providence, Springfield, Mass., Washington and Worcester show more circuit than direct wires, and it will be noticed that five out of these six are cities in New England—where the two, three and four "party lines" seem to be still popular, to a great extent.

Table No. 12, salaries of operators, is compiled from the reports of 47 exchanges, employing 1,435 operators.

TABLE NO. 11.

SALARIES OF OPERATORS.

47 Exchanges, 1,435 Operators.	Weekly Salary.
Highest (including Chief Operator)	$25 00
Lowest	4 50
Average	5 70

Detroit pays the highest salary, and Reading the lowest.

Los Angeles shows the highest average salary, $8.12, while Bay City and Springfield, Ill., report the lowest average, $3.86.

The general average is $5.70 as against $6.39 last year.

The next table, No. 12, shows the wages paid to linemen and inspectors.

TABLE No. 12.

SALARIES OF LINE AND INSTRUMENT MEN.

47 Exchanges, 268 Men.	Daily Pay of		
	Line Men.	Instrument Men,	Comb'n Men.
Highest	Detroit....$3.65	Louisville..$3.30	New York..$3.07
Lowest	Detroit..... 1.00	Atlanta.... .85	East Saginaw 1.45
Average	1.99	1.81	1.97

Forty-seven exchanges employing 268 men are included in this table.

UNDERGROUND WORK.

Only eight out of the forty-eight exchanges reporting, appear to have had experience in underground work, viz: New York, Brooklyn, Boston, Detroit, Pittsburgh, Buffalo, Washington and Louisville.

By the reports from these exchanges, there are actually in use at the present time 17,510⅛ miles of underground conductors. In addition to this, Pittsburgh reports having 1,450¾ miles of underground conductors laid, which are not yet in use. New York naturally has the greatest mileage, 7034.668 miles, while Louisville reports the smallest, about 350 miles.

The longest underground conductor now in use is stated by New York to be 26,689 feet, or a trifle over five miles in length.

The average number of conductors in each cable appears to be 50 pair, or 100 single wires.

In answer to the last question of all, viz: "What is the age of the oldest underground conductor now used by you, which has given satisfactory service since it was first put in use?," the championship is claimed by Pittsburgh, which laid the first underground route, June 26, 1882, the conductors on which route have therefore been working successfully for over seven years.

This is the first year that statistics relating to the underground business have been collated, for the reason that but few exchanges have as yet adopted, to any extent, that method of construction; but as the answers sent in this season show that one-sixth of the total number of exchanges reporting have experimented more or less in this direction, it is fair to presume that another year will develop facts of more value than those shown in this, the first attempt at collecting information relating to subterranean work.

Respectfully submitted,

C. H. BARNEY,
Secretary.

THE SECRETARY—Before we adjourn, I would like to call attention to one thing: our Constitution provides that the place and time of the next annual meeting shall be fixed by this meeting. It has become customary for one meeting to decide upon the place for the next, as we have done, and to pass a vote leaving the fixing of the date to the Executive Committee. It is necessary to pass such a vote, so that the committee may have the power to do it. Otherwise, they would not have that power.

MR. E. J. HALL, JR.—I move that the fixing the date for the next meeting be referred to the Executive Committee, with power.

This motion was duly seconded and carried.

On motion, duly seconded, the Association adjourned *sine die* at 11:15 P. M.

C. H. BARNEY,
Secretary.

The next meeting of the Association will be held in Detroit, at a date to be hereafter decided upon by the Executive Committee.

APPENDIX A.

Hospitalities Extended to the Members of the National Telephone Exchange Association while En Route and in Minneapolis.

The Eastern delegates to the meeting at Minneapolis were conveyed thither in the "Special Telephone Limited" train, provided by the Pennyslvania Railroad Company, consisting of Pullman sleeping cars, a dining car, and a composite car, containing a smoking apartment, library, bath-room, etc. The train was, in every respect, one of the finest ever run on any road, and the fatigue of the journey was reduced to a minimum. Fifty-two persons, including fifteen ladies, made the trip from New York, and twenty-five more joined the party at Chicago.

At the latter city a stop was made of eight hours, during which the entire delegation was handsomely entertained by the Chicago Telephone Company and the Central Union Telephone Company, by a luncheon at the rooms of the Electric Club, and a carriage drive around the city, the arrangements for the entertainment being admirably made by Messrs C. H. Wilson and F. G. Beach. The pleasures of the day spent in Chicago will not soon be forgotten by those who were so fortunate as to be of the party.

In Minneapolis the delegates to the Association were the special guests of the Northwestern Telephone Exchange Company, and the officers of that organization exerted themselves early and late to make the Minneapolis meeting memorable in the history of the Association. They succeeded admira-

bly. The visitors were splendidly entertained. The members are under special obligation to Messrs. McKinstry and Glidden, who took it upon themselves to see personally that everything which could contribute to the pleasure and comfort of the delegates was provided.

Aside from the business of the Convention, the most significant events of the meeting were the drive and banquet on Thursday, to which they were invited by the Northwestern Telephone Exchange Company. At 9:30 carriages were at the door of the West Hotel, and for an hour or more the delegates were driven through the most beautiful portion of Minneapolis. It is a city of splendid buildings and beautiful homes. In every way the drive was enjoyable.

The delegates were driven to the motor station, where cars were taken for Minnehaha. A half hour was passed in viewing the falls and in dispatching lunch, which the hosts of the day had provided. After the party had been photographed a train was taken for St. Paul, which was reached at one o'clock. Carriages were in waiting at the depot, and the party enjoyed its second drive, this time up and down the hills of St. Paul. When the drive had been finished the delegates were at loss to determine which city contained the more beautiful homes and the more imposing buildings —Minneapolis or St. Paul. It is still a mooted question.

The drive ended at the Ryan Hotel, where a banquet was in readiness. The dinner was prepared in the style for which the Ryan is famous.

Levi Sprague, President of the Northwestern Telephone Exchange Company, presided. In calling the guests together, after the dinner, he said: "I am very glad to see so many of you, and I give you a hearty welcome. I now have the pleasure of introducing Charles E. Adams, of the Northwestern Telephone Exchange Company." Mr. Adams acted as toastmaster.

In response to the toasts offered, speeches were made by William D. Sargent, President, and C. H. Barney, Secretary of the Association; Thomas D. Lockwood, of the American Bell Telephone Company; W. D. Hall, Secretary of the

Board of Trade of Minneapolis; C. W. Price, of the *Electrical Review;* W. H. Eustis, of Minneapolis; Gustav Wabner, of Berlin; Edward J. Hall, Jr., of the American Telephone and Telegraph Company; J. M. Jackson, of the Western Electric Company, and C. J. Glidden, of the Erie Telephone and Telegraph Company.

APPENDIX B.

OFFICERS FOR THE YEAR 1889–1890.

President.

WILLIAM D. SARGENT, - - Brooklyn, N. Y.

Vice-President.

FRANK G. BEACH, - - - - - Chicago, Ill.

Secretary.

C. H. BARNEY, - - - - - New York City.

Treasurer.

HENRY L. STORKE, - - - - New York City.

Advisory Committee.

For three years—GEORGE N. STONE, Cincinnati, O.
For two years—MORRIS F. TYLER, New Haven, Conn.
For one year—EDWARD J. HALL, JR., New York City.

Executive Committee.

WM. D. SARGENT, *Ex-officio*, - - Brooklyn, N. Y.
CHARLES F. CUTLER, - - New York City.
CHARLES H. WILSON, - - - Chicago, Ill.
H. N. GIFFORD, - - - - - Louisville, Ky.
LEVI SPRAGUE, - - - - - - Lowell, Mass.

APPENDIX C.

ROLL OF ACTIVE MEMBERS,

SEPTEMBER 12, 1889.

American Telephone & Telegraph Co., New York City.
Bell Telephone Co. of Buffalo, Buffalo, N. Y.
Bell Telephone Co. of Missouri, St. Louis, Mo.
Bell Telephone Co. of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Central Union Telephone Co., Chicago, Ills.
Chicago Telephone Co., Chicago, Ills.
City & Suburban Telegraph Association, Cincinnati, O.
Colorado Telephone Co., Denver, Col.
Chesapeake & Potomac Telephone Co., Washington, D. C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Cumberland Telephone & Telegraph Co., Nashville, Tenn.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
Empire State Telephone & Telegraph Co., Auburn, N. Y.
Erie Telephone & Telegraph Co., Lowell, Mass.
Great Southern Telephone & Telegraph Co., New Orleans, La.
Hudson River Telephone Co., New York City.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City, Mo.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.
New York & New Jersey Telephone Co., Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York City.

New England Telephone & Telegraph Co., Boston, Mass.
Ohio Valley Telephone Co., Louisville, Ky.
Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburg, Pa.
Rocky Mountain Bell Telephone Co., Salt Lake City, Utah.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven, Conn.
Wisconsin Telephone Co., Milwaukee, Wis.

ASSOCIATE MEMBERS.

American Electrical Works, Providence, R. I.
Felton & Guillaume, Cologne, Germany.
J. A. Roebling's Son's Co., New York City.
National Conduit Manufacturing Co., New York City.
Standard Electrical Works, Cincinnati, Ohio.
Western Electric Co., Chicago, Ills.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Washington, D. C.
Bell Telephone Co. of Canada, Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, Geo. L., New York City.
Bailey, C. E., Havana, Cuba.
Berthon, A. F., Paris, France.
Childs, W. A., New York City.
Cheever, Charles A., New York City.
Cassidy, John, Honolulu.
Dana, R. K., New York City.
Day, A. G., New York City.
Electrical Supply Co., New York City.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington, D. C.
Madden, O. E., New York City.
Phillips, E. F., Providence, R. I.
Potter, F. I., Pittsfield, Mass.

Pope, H. W., New York City.
Sawyer, W. H., Providence, R. I.
See, I. W., Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., New York City.
Williams, Jr., Charles, Boston, Mass.
Wiley, George L., New York City.
Lemon, C., Wellington, New Zealand.

APPENDIX D.

CONSTITUTION.

ARTICLE I.—NAME.

The name of the Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual, but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, provided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing, notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and an Executive and Advisory Committee, who shall, with the exception of the Secretary and the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—Vice-President.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—Secretary.

The Secretary shall keep a record of the proceedings of all the meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—Treasurer.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—Executive Committee.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by the provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Secretary and transmit to the Association all applications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting, and the action of this Committee shall not be final, but advisory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—Advisory Committee.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws, as in their opinion will best further the aims and purposes of the Association.

3 The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, affecting telephone interests, and shall report thereon to the Association with such recommendations at it may deem advisable.

4. It may also consider any questions touching the interests of the members

of this Association that may be referred to it, and may call for papers or other documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, as far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committee which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other persons, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. The Association at its annual meeting, by a two-thirds vote of the members present, shall designate the time and place of the next annual meeting.

2. Special meetings of the Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the constitution, and shall be payable yearly on or before the first day of October in each year for the year ending August 31st, thereafter.

2. The Association may, by resolution adopted by a majority of all the voters of the Association, make assessments on the members thereof, and such

assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

ARTICLE XV.—Expulsion.

Any member may be suspended or expelled for misconduct, or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—Amendments.

1. This Constitution shall go into effect immediately.

2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

3. Notice of such proposed change should be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post-office address of each member.

ARTICLE XVII.—Honorary Membership.

1. Any person nominated by the Executive Committee may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such elections to be by ballot.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

ARTICLE XVIII.—Associate Membership.

1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

2. An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments.

APPENDIX E.

BY-LAWS.

ARTICLE I.—ELECTION OF OFFICERS.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—PRESIDENT.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—SECRETARY.

1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the objeet for which they are called; and shall keep correctlv the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipts and disposal upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

5. Shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business as have heretofore been furnished by the various committees of this Association.

ARTICLE IV.—TREASURER.

1. The Treasurer shall keep an accurate roll of the members, and shall collect, and under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

2. Shall keep regular books of accounts, which shall be opened to inspection by any member of the Executive Committee.

3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—COMMITTEES.

1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of the Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said committee, who will, in case it is not deemed expedient to hold a meeting of said committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report with the Secretary.

2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this committee.

ARTICLE VI.—MEMBERSHIP.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of its Board of Directors, make application for membership, and shall forward a copy of such proceedings properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—NON-PAYMENT OF DUES.

If any member fails to pay the yearly dues or assessments within one month from the first day of October, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that unless the same are paid within one month thereafter, the default will be re-

ported to the Executive Committee ; which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—AMENDMENTS.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting ; provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—SUSPENSION OF RULES.

These rules may be suspended at any meeting of the Association by a majority of all votes represented at such meeting.

ARTICLE X.—STATISTICAL COMMITTEE.

At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be ex-officio chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require.

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TWELFTH MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

ASSOCIATION,

HELD AT

The Russell House, Detroit, Mich.,

September 9th and 10th, 1890.

1890.

"THIS ASSOCIATION DISCLAIMS RESPONSIBILITY FOR ANY PAPER READ AT ITS MEETINGS, UNLESS SO EXPRESSED BY A SPECIAL RESOLUTION."—*Resolution passed at the Minneapolis meeting of the National Telephone Exchange Association, September 10, 1889.*

PRESS OF
BROOKLYN EAGLE BOOK PRINTING DEPARTMENT,
BROOKLYN, N. Y.

TWELFTH MEETING

OF THE

National Telephone Exchange Association

HELD AT THE

RUSSELL HOUSE, DETROIT, MICH.,

SEPTEMBER 9th and 10th, 1890.

FIRST DAY'S PROCEEDINGS.

MORNING SESSION.

The Association was called to order at 11:30 A. M., the President, William D. Sargent, of Brooklyn, N. Y., in the chair, and C. H. Barney, of New York Secretary.

THE PRESIDENT—Gentlemen, the first business is the calling of the roll. Gentlemen will please answer to their names as they are called by the Secretary. I may say, before the roll-call, that Mr. Jackson requested me to announce that he had expected that the Mayor of the city would be here to welcome us, but he tells me that the Mayor has been called away on some important business, and will not be able to be present.

THE SECRETARY—If the members of the Association, besides answering to the names of the companies which they represent, will kindly fill out the cards which Mr. Morgan will distribute, and send them up to the Secretary's desk, it will greatly facilitate the making up of the roll.

The Secretary then called the roll, and the following members were found to be present, or were reported as present later in the session :

ACTIVE MEMBERS.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—Edward J. Hall, Jr., Vice-President and General Manager; Angus S. Hibbard, General Superintendent; F. A. Pickernell, Electrician; Francis J. Hovey, Special Agent, Howard P. Marshall, C. E. Mosley; Edward P. Meany.

BELL TELEPHONE COMPANY OF BUFFALO, Buffalo, N. Y.—Edward J. Hall, Vice-President and General Manager; Harlow C. Palmer, Secretary and Treasurer; Jno. N. Culbertson, General Superintendent.

CENTRAL PENNSYLVANIA TELEPHONE AND SUPPLY COMPANY, Williamsport, Penn.—R. M. Bailey, General Manager.

CENTRAL UNION TELEPHONE COMPANY, Chicago, Ill.—Frank G. Beach, General Superintendent; J. E. Zueblin, Assistant General Superintendent; M. J. Carney.

CHESAPEAKE AND POTOMAC TELEPHONE COMPANY, Washington, D. C.—A. O. Morgan, Director.

CHICAGO TELEPHONE COMPANY, Chicago, Ill.—Charles H. Wilson, Superintendent.

DELAWARE AND ATLANTIC TELEPHONE AND TELEGRAPH COMPANY, Philadelphia, Penn.—W. T. Westbrook, Superintendent.

EMPIRE STATE TELEPHONE AND TELEGRAPH COMPANY, Auburn, N. Y.—H. L. Storke, President; D. A. Smith, Vice-President.

ERIE TELEPHONE AND TELEGRAPH COMPANY, Lowell, Mass.—J. P. McKinstry, General Manager; P. Yensen, District Superintendent.

GREAT SOUTHERN TELEPHONE AND TELEGRAPH COMPANY, New Orleans, La.—A. W. Crandell, President.

HUDSON RIVER TELEPHONE COMPANY, New York City.—A. B. Uline, Vice-President and General Manager; H. L. Storke, Secretary and Treasurer.

METROPOLITAN TELEPHONE AND TELEGRAPH COMPANY, New York City.—J. J. Carty, Superintendent of Equipment.

MICHIGAN TELEPHONE COMPANY, Detroit, Mich.—William A. Jackson, General Manager; F. A. Forbes, General Superintendent; James R. Dee, Division Superintendent; James F. Land, S. E. Watson, W. D. Greene, G. J. Carroll.

MISSOURI AND KANSAS TELEPHONE COMPANY, Kansas City, Mo.—Charles W. McDaniel, Superintendent; J. O. Stockwell.

NEBRASKA TELEPHONE COMPANY, Omaha, Neb.—C. E. Yost, Vice-President and General Manager; Flemon Drake, General Superintendent.

NEW ENGLAND TELEPHONE AND TELEGRAPH COMPANY, Boston, Mass.—J. N. Keller, General Manager; I. H. Farnham, Electrician.

NEW YORK AND NEW JERSEY TELEPHONE COMPANY, Brooklyn, N. Y.—W. D. Sargent, Vice-President and General Manager.

NEW YORK AND PENNSYLVANIA TELEPHONE COMPANY, New York City.—W. N. Estabrook, General Manager.

OHIO VALLEY TELEPHONE COMPANY, Louisville, Ky.—James Clarke, Vice-President and Treasurer; H. N. Gifford, General Manager.

PENNSYLVANIA TELEPHONE COMPANY, Harrisburgh, Pa.—Josiah R. Davis, General Manager.

PROVIDENCE TELEPHONE COMPANY, Providence, R. I.—A. C. White, Superintendent.

ROCKY MOUNTAIN BELL TELEPHONE COMPANY, Salt Lake City, Utah.—Geo. Y. Wallace, President; D. S. Murray.

SOUTHERN BELL TELEPHONE COMPANY, New York City.—D. I. Carson, Secretary and General Superintendent; W. J. Cole, Third District Superintendent.

SOUTHERN MASSACHUSETTS TELEPHONE COMPANY, New Bedford, Mass.—Samuel Ivers, Treasurer.

SOUTHERN NEW ENGLAND TELEPHONE COMPANY, New Haven, Conn.—Morris F. Tyler, President.

WISCONSIN TELEPHONE COMPANY, Milwaukee, Wis.—John D. McLeod, Superintendent.

ASSOCIATE MEMBERS.

NATIONAL CONDUIT MANUFACTURING COMPANY, New York City.—James P. McQuade, Treasurer; H. G. Stockwell.

STANDARD ELECTRICAL WORKS, Cincinnati, O.—E. V. Cherry, President.

WESTERN ELECTRIC COMPANY, Chicago, Ill.—E. M. Barton, President; H. B. Thayer, Manager New York Office; Geo. A. Hamilton, C. D. Crandall, C. E. Scribner, W. R. Patterson.

HONORARY MEMBERS.

AMERICAN BELL TELEPHONE COMPANY, Boston, Mass.—A. O. Morgan, Thos. D. Lockwood, Thos. B. Doolittle, J. M. Brown, Frank B. Knight, Wm. A. Hovey, H. S. Huidekoper, George Albree, George G. Hall, Arthur G. Fuller, special agents.

BELL TELEPHONE COMPANY OF CANADA, Montreal, P. Q.—L. B. McFarlane, Manager Eastern Department.

BRIDGEPORT BRASS COMPANY, Bridgeport, Conn.—Henry D. Stanley.

CHEEVER, CHAS. A., New York City, by Geo. T. Manson.

CHILD, W. A., New York City.

LOCKWOOD, THOS D.

WILEY, GEO. L., New York City, by Fred. E. Degenhardt.

There were present at the meeting 26 active, 3 associate and 7 honorary members, represented by 74 delegates. Twenty-three other persons interested in electrical matters,

but not connected with the Association, were in attendance upon the sessions of the same.*

THE PRESIDENT—The next business is application for membership. Are there any applications?

THE SECRETARY—I have received no new applications.

THE PRESIDENT—The next business before the meeting will be the reading of the Secretary's report.

The Secretary read his report as follows:

SECRETARY'S REPORT.

NEW YORK CITY, September 2d, 1890.

To the National Telephone Exchange Association:

GENTLEMEN—I have the honor respectfully to submit my report as Secretary of this Association, for the year ending August 31, 1890.

At the beginning of the Association year the roll contained the names of 34 active, 6 associate, and 27 honorary members.

The changes during the year have been as follows:

At the Minneapolis meeting, the resignation of the Sunset Telephone-Telegraph Company, of San Francisco, as an active member, and of Clark B. Hotchkiss as an associate member, were both accepted, and the Callender Insulating and Water-proofing Company was dropped from the roll of honorary members, it having gone out of business.

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*The following institutions, individuals, newspapers and business concerns, not members of the Association, were also in attendance at the meeting, viz.:

Ansonia Brass and Copper Company, New York City, by Gilbert M. Smith.
Baker & Company, Newark, N. J., by Cyrus O. Baker, Jr.
Bunnell & Company, J. H., New York City, by J. J. Ghegan.
Central Electric Company, Chicago, Ill., by W. H. McKinloch.
Clark, James, Jr., Louisville, Ky.
Detroit Electrical Works, Detroit, Mich., by Paul W. Bossart.
Doolittle, Chas. B., Bridgeport, Conn.
Edison Manufacturing Company, New York City, by J. F. Kelly.
"Electric Age," New York City, by Thos. R. Taltavall.
"Electrical Engineer," New York City, by W. Forman Collins, Western Manager.
"Electrical Industries," Chicago, Ill., by E. L. Powers.
"Electrical Review," New York City, by Charles W. Price, Associate Editor.
"Electrical World," New York City, by C. E. Stump, Business Manager; Fred. De Land, Chicago Rep.
E. S. Greeley Company, The, New York City, by Frank A. Magee.
Mason, Frank C., Supt. Police Telegraph, Brooklyn, N. Y.
Miami Telephone Company, Xenia, Ohio, by Warren Anderson.
Morrison, C. A., New York City, Official Stenographer.
Norwich Insulated Wire Company, Brooklyn, N. Y., by Louis D. Beck, President; Jean A. Wetmore.
"Western Electrician," Chicago, Ill., by J. W. Dickerson and A. C. Durburow
Wyckoff Pipe Company, by Frank T. Wyckoff.

At the same meeting the Cumberland Telephone and Telegraph Company was re-elected to active membership, and Messrs. Felten and Gilleaume, of Cologne, Germany, were elected as associate members.

Mr. A. G. Day, an honorary member, has died during the year.

These changes leave us with a membership at the close of the Association year as follows: Active, 34; associate, 6; honorary, 25.

There is now in my hands, to be presented to the Association, the resignation of the City and Suburban Telegraph Association, of Cincinnati, as an active member, and of J. A. Roebling's Sons Company, of New York City, as an associate member.

The office of the Secretary has remained at 510 West Twenty-third street, New York City, during the entire year.

The usual number of inquiries for information have been received and replied to, and the NEWS LETTER has been regularly issued, semi-monthly, until January 1st, 1890, and monthly since that date.

The Treasurer's report will show that the income of the Association has, during the past year, considerably exceeded its expenses, by reason of a reduction in the latter. There is now in the treasury a balance of $320.99, as against $66.41 at the beginning of the year.

All accounts due the Association have been collected, and all debts of the Association have been paid to the end of the fiscal year.

The income of the year was derived as follows:

From annual dues	$1,950 00
" initiation fees	10 00
" sales of extra copies of proceedings	49 15
Total	$2,009 15

The expenses have been distributed as follows:

For salary of Secretary	$1,000 00
" printing proceedings, Minneapolis meeting	245 25
" other printing, NEWS LETTER, circulars and blanks	129 40
" office expenses, stationery, postage, telegrams, express and newspaper clippings	98 06
" stenographer at Minneapolis meeting	136 50
" other expenses at Minneapolis meeting	145 36
Total	$1,754 57

Respectfully submitted,

C. H. BARNEY,
Secretary.

THE PRESIDENT—What is your pleasure?

On motion, duly seconded, the report was accepted and placed on file.

THE SECRETARY—Mr. President, as has been stated in my report, there are the resignations of the City and Suburban Telegraph and Telephone Company of Cincinnati, as an active member, and of J. A. Roebling's Sons Company, of New York, as an associate member. Both these resignations were received at about the beginning of this Association year, or within a few days after the Minneapolis meeting. There having been no meeting since of the Association, or of the Executive Committee, they could not be acted upon until the meeting of the Executive Committee last evening.

THE PRESIDENT—The resignations require the action of the Association. A motion would be in order.

On motion of Mr. Gifford, duly seconded, the resignations were accepted.

THE SECRETARY—I have also received the resignation of Mr. George N. Stone as a member of the Advisory Committee of this Association.

On motion of Mr. Uline, duly seconded, the resignation was accepted.

THE PRESIDENT—The next business in order will be the reading of the Treasurer's report.

THE TREASURER—I have a report here of the details of the Association's business, and the vouchers, which have been examined and approved by the Executive Committee. The balance brought forward from last year was $66.41; cash on hand, $320.99. This is an improvement of about 500 per cent. over the report made a year ago. Shall I read the report in detail?

A MEMBER—I move that the reading of the report be dispensed with, and that it be accepted and placed on file.

The motion was duly seconded and carried.

NATIONAL TELEPHONE EXCHANGE ASSOCIATION.

TREASURER'S STATEMENT FOR THE YEAR ENDING AUGUST 31ST, 1890.

RECEIPTS.			DISBURSEMENTS.		
1889.			1889.		
Sept. 1—To balance		$66 41	Sept. 27—By C. G. Braxmar, Voucher No. 268	$37 50	
" 10—" The City and Suburban Telegraph Association, Dues for 1890	$50 00		" 27—" C. H. Barney, " " 269	107 86	
					145 36
" 10—" Standard Electrical Works, Dues for 1890	50 00		Oct. 11—" C. F. Johnson, " " 270	136 50	
			" 11—" C. H. Barney, " " 271	100 00	
" 10—" Delaware and Atlantic Telephone and Telegraph Co., Dues for 1890	50 00		" 11—" American Press Information Bureau, Voucher No. 272	1 10	
					237 60
" 10—" The Ohio Valley Telephone Co., Dues for 1890	50 00		Nov. 14—" The Electrical Review, Voucher No. 273	3 00	
" 10—" Western Electric Co., Dues for 1890	50 00		" 14—" C. H. Barney, Voucher No. 274	100 00	
" 10—" The Bell Telephone Co., of Missouri, Dues for 1890	50 00		" 14—" American Press Information Bureau, Voucher No. 275	5 80	
" 10—" American Telephone and Telegraph Co., Dues for 1890	50 00		" 14—" C. H. Barney, Voucher No. 276	19 45	
		350 00			128 25
" 19—" Central District and Printing Co., Dues for 1890	50 00		Dec 9—" Jersey City Printing Co., Voucher No. 277	52 40	
			" 9—" C. H Barney, Voucher No. 278	100 00	
			" 9—" Brooklyn Daily Eagle, Voucher No. 279	3 00	
Carried forward		$416 41	Carried forward		$511 21

	Brought forward		$416 41
Sept.	19—To Pacific Bell Telephone Co., Dues for 1890	50 00	
"	19— " Wisconsin Telephone Co., Dues for 1890	50 00	
"	19— " Metropolitan Telephone and Telegraph Co., Dues for 1890	50 00	
"	19— " New York and New Jersey Telephone Co., Dues for 1890	50 00	
"	19— " Erie Telephone and Telegraph Co., Dues for 1890	50 00	
"	19— " Pennsylvania Telephone Co., Dues for 1890	50 00	
			350 00
"	20— " New England Telephone and Telegraph Co., Dues for 1890	50 00	
"	" — " Central Union Telephone Co., Dues for 1890	50 00	
"	" — " Michigan Telephone Co., Dues for 1890	50 00	
			150 00
"	21— " Chesapeake and Potomac Telephone Co., Dues for 1890	50 00	
"	" — " American Electrical Works, Dues for 1890	50 00	
			100 00

	Brought forward		$511 21
Dec.	9—By American Press Information Bureau.....Voucher No. 280..	6 05	
			161 45
1890.			
Jan.	16— " Jersey City Printing Co., Voucher No. 281	22 50	
"	16— " C. H. Barney, Voucher No. 282..	100 00	
"	16— " American Press Information Bureau.....Voucher No. 283..	5 40	
			127 90
Mch.	21— " C. H. Barney, Vouchers Nos. 284–288		150 00
May	16— " American Press Information Bureau.....Voucher No. 285 .	6 15	
"	" — " C. H. Barney, Voucher No. 286..	12 06	
"	" — " Brooklyn Daily Eagle, Voucher No. 287	245 25	
"	" — " American Press Information Bureau.....Voucher No. 289..	3 65	
"	" — " ..... " " 290..	8 55	
"	" — " Jersey City Printing Co., Voucher No. 291	12 75	
"	" — " C. H. Barney, Voucher No. 292..	150 00	
			438 41
June	25— " C. H. Barney, Voucher No. 293..		150 00

Sept. 23	To New York and Pennsylvania Telephone and Telegraph Co., Dues for 1890		50 00
" 30	" Colorado Telephone Co., Dues for 1890		50 00
Oct. 7	" Nebraska Telephone Co., Dues for 1890	50 00	
" "	" Missouri and Kansas Telephone Co., Dues for 1890	50 00	
			100 00
" 10	" Bell Telephone Co., of Philadelphia, Dues for 1890		50 00
" 22	" Southern New England Telephone Co, Dues for 1890		50 00
" 24	" Felten and Guilleaume, Initiation Fee	10 00	
	Dues for 1890	50 00	
" "	" Great Southern Telephone and Telegraph Co., Dues for 1890	50 00	
			110 00
" 31	" Southern Bell Telephone and Telegraph Co., Dues for 1890		50 00
Nov. 1	" Providence Telephone Co., Dues for 1890		50 00
" 8	" Central Pennsylvania Telephone and Supply Co., Dues for 1890		50 00
	Carried forward		$1,576 41

Aug. 5	By C. H. Barney, Voucher No. 294	75 00	
" "	" American Press Information Bureau.....Voucher No. 295	6 50	
" "	" Jersey City Printing Co., Voucher No. 296	32 50	
" "	" Brooklyn Daily Eagle, Voucher No. 297	2 25	
			116 25
" 30	" C. H. Barney, Voucher No. 299	75 00	
" "	" " " 301	13 20	
" "	" Jersey City Printing Co., Voucher No. 298	4 00	
" "	" American Press Information Bureau.....Voucher No. 300	7 15	
			99 35
" "	" balance		320 99
	Carried forward		$2,075 56

Brought forward		$1,576 41
Nov. 15—To Hudson River Telephone Co., Dues for 1890		50 00
" 29— " Empire State Telephone and Telegraph Co., Dues for 1890		50 00
Dec. 21— " Chicago Telephone Co., Dues for 1890		50 00
1890.		
Jan. 17— " Bell Telephone Co., of Canada, copies of proceedings, 1889 meeting and postage		3 15
" 21— " American Bell Telephone Co., copies of proceedings, 1889 meeting		2 00
Feb. 4— " Erie Telephone and Telegraph Co., copies of proceedings, 1889 meeting	20 00	
" "— " G. Willis Pierce, copies of proceedings, 1889 meeting	1 00	
		21 00
March 4— " To Western Electric Co., copies of proceedings, 1889 meeting		6 00
" 22— " Wisconsin Telephone Co., copies of proceedings, 1889 meeting	2 00	
" "— " Cumberland Telephone and Telegraph Co., Dues for 1890	50 00	

Brought forward	$2,075 56

March 22—To Rocky Mountain Bell Telephone Co., Dues for 1890.....	50 00		
		102 00	
April 24— " Bell Telephone Co., of Buffalo, Dues for 1890.....	50 00		
" " — " Western Electric Co., copies of proceedings, 1889 meeting.....	4 00		
		54 00	
June 28— " Western Electric Co., copies of proceedings, 1889 meeting....		2 00	
Aug. 7— " Western Electric Co., copies of proceedings, 1889 meeting.....	2 00		
" "— " Southern Bell Telephone and Telegraph Co., copies of proceedings, 1889 meeting.....	3 00		
		5 00	
" 11— " Central New York Telephone and Telegraph Co., Dues for 1890..		50 00	
" 15— " Southern Massachusetts Telephone Co., Dues for 1890.....		50 00	
" 19— " National Conduit Manufacturing Co., Dues for 1890.....		50 00	
" 30— " Western Electric Co., copies of proceedings, 1889 meeting.....		4 00	
		$2,075 56	$2,075 56

THE PRESIDENT—The next business is the reading of the minutes of the meeting of the Executive Committee.

The Secretary then read the minutes, as follows:

MINUTES OF MEETING OF EXECUTIVE COMMITTEE,

HELD SEPTEMBER 8, 1890.

The Committee met at the Russell House, Detroit, Mich., at 9 P. M. Present, President Sargent, Wilson and Gifford.

The Treasurer's report for the past year was audited and found correct.

It was voted to recommend to the Association the acceptance of the resignations of the City and Surburban Telegraph Association, as an active member, and of J. A. Roebling's Sons Co. as an associate member, and of George N. Stone, as a member of the Advisory Committee.

It was voted to recommend to the Association that the hours of meeting on Tuesday, 9th instant, be from 11 A. M. to 1 P. M., and from 3 to 5 P. M., and that the hours of meeting for Wednesday, 10th instant, be from 10 A. M. to 12.30 P. M.

There being no further business, the Committee adjourned.

C. H. BARNEY,
Secretary.

THE PRESIDENT—You have heard the report, gentlemen; what is your pleasure?

MR. E. J. HALL, JR.—I move that the report be received and the recommendations contained therein be adopted.

The motion was seconded, put and carried.

MR. GIFFORD—Perhaps some of the members do not understand the hours of meeting which the report of the Executive Committee has mentioned, and I would suggest that the Chair repeat them.

THE PRESIDENT—From 11 o'clock to 1 o'clock, and from 3 o'clock to 5 o'clock, to-day, and to-morrow from 10 o'clock until 12 30. If there is to be any extension of the time a motion to that effect can be made at the session to-morrow morning.

MR. GIFFORD—I believe it would be correct to state that the Committee thought that all the business could be transacted in these two days, and if it was necessary to extend the time longer we could arrange to do so on Thursday morning.

THE PRESIDENT—Yes; of course, the Association will take whatever action it pleases at to-morrow morning's session about that.

MR. JACKSON—I would announce, Mr. President, that there will be a carriage drive tendered to the members of the Association and those attending this Convention to-morrow at 2 o'clock, weather permitting. We will drive around the city and to Island Park, and a lunch will be served at the Casino. This invitation is general to both gentlemen and ladies accompanying them, to all who are here at the Convention; there will be no printed invitations for the drive. For the other entertainments there will be printed invitations issued, and therefore I beg to announce that all are invited and we hope all will come. Ample preparations have been made for all who wish to participate. [Applause.]

THE PRESIDENT—I may say that the Committee had notice of this invitation, and that the hours were arranged to make it possible for members to accept the hospitality of the Detroit Company.

THE TREASURER—I suppose that that spontaneous outburst of applause was equivalent both to accepting the invitation and to thanking the donors for it. If it is not, I would move that the invitation so gracefully tendered us by Mr. Jackson be received with thanks. [Applause]

The motion was duly seconded and carried.

THE PRESIDENT—The next business is the nomination and election of officers, but before nominations are made I will ask the indulgence of the Association to listen to a few remarks that appear to be pertinent to the occasion of the tenth anniversary of the Association. On the 7th of September, just ten years ago, the first convention of telephone men assembled at Niagara Falls. The meeting was the result of a circular sent out some time beforehand, signed by representatives of the leading telephone companies in the United States. The object of the convention, as stated in the circular, was, "the formation of a general telephone

association to consider the various questions affecting the telephone business and its development." This meeting was organized by the election of George F. Durant as Chairman, and E. J. Hall, Jr., as Secretary. The roll of representatives showed 86 individuals, representing various companies, 6 representatives of the American Bell Telephone Company, and 21 representatives of manufacturing interests; making a total of 113 individuals. A constitution and by-laws were offered, and various reports and papers were listened to and discussed, after which the convention, on the morning of September 9th, adjourned *sine die*. Immediately following this adjournment, and on the same day of which this is the anniversary, the first meeting of the National Telephone Exchange Association of the United States assembled. The present constitution and by-laws were adopted and the following officers elected: President, George L. Phillips; Vice-President, H. H. Eldred; Secretary, M. F. Tyler; Treasurer, D. I. Carson. The Association then adjourned to meet in Chicago on the first Tuesday in April. The subsequent meetings in Saratoga, Boston, Cincinnati, Philadelphia, and so forth, are a part of the history of our business.

Of the original members many have left the business, and a few—but all too many—have been taken away by death, notably our universally esteemed first President, George L. Phillips, and others no less dear, and of whom the Association has expressed its appreciation in just and loving tributes to their merits.

Ten years ago, how crude the business was. The multiple switch-board was a mere idea. Cables were only hinted at. The use of iron or steel wires was almost universal. Insulation was considered of little account by many, and some declared insulators superfluous [laughter]; the value of the service was underrated by the public, and our own standards were far below those of to-day. The highest efficiency and reliability is what the public demand of us, and business and prosperity will follow us just as fast

as we are able to meet that demand. The standard of to-day requires the use of copper for conductors, overhead as well as underground, and the substitution of metallic circuits for single grounded wires. The underground wires and cables of five years ago do not answer the requirements of to-day, and the same may be said of central office and subscribers' equipments. With improved service comes increased use by the public, and the ability and energies of the best minds in the business may well be taxed to the utmost to keep up with the demand.

This Association has in the past been active in the development and extension of new ideas and improved methods, and it is therefore with regret that I call your attention to the lack of interest and the falling off in membership during the past three or four years. The City and Suburban Telephone and Telegraph Company, of Cincinnati, have resigned, and the active membership is now only 33. The Secretary's request for papers to be read at this meeting met with no response. The papers which we have were procured by personal solicitation on the part of the officers. It may be said, indeed, that outside of the Secretary's statistical report, the furnishing of papers to serve as topics for discussion during the last few years has been done by a very few individuals. If the Association is to be of service in the future, its members generally must take a more active part in the preparation of the papers and reports which form the basis for our discussions.

In conclusion, I desire to thank the Association for the kindly manner in which they have treated an inexperienced presiding officer. [Applause.]

MR. CRANDELL—Did I understand the Chair to announce that the next order of business was the nomination of officers?

THE PRESIDENT—Yes, sir; nominations are now in order.

MR. CRANDELL—Then I desire to place in nomination a gentleman, who a few years ago composed one of the

vanguard that was leading the way in teaching many of the members of this Association what telephoning would be; I desire to place in nomination a gentleman who has filled many important positions in telephone service, and has never been found wanting in any; I desire to place in nomination a gentleman who is now filling a position in the telephone service, and who has filled it, I believe, to the satisfaction of every member of this Association. I have the honor to nominate for President of this Association, for another year, our worthy President, Mr. Sargent. [Applause.]

The nomination was duly seconded, and the question being put by Mr. Crandell, the Secretary was unanimously instructed to cast the ballot of the Association for Mr. Sargent.

THE PRESIDENT—Gentlemen, I can only return my sincere thanks for the continued honor bestowed upon me, and I trust that our relations in the future will be quite as pleasant as they have been in the past. We will proceed to the next business, which is the nomination of a Vice-President.

MR. WILSON—I desire to nominate for Vice-President Mr. F. G. Beach. [Applause.]

The motion was duly seconded.

MR. TYLER—I move that in the absence of other nominations, the Secretary be directed to cast one ballot for Mr. Beach.

The motion was seconded and carried unanimously, and Mr. Beach declared elected Vice-President.

MR. BEACH—This is a matter of great surprise to me, and I can simply say that I thank you all heartily. [Applause.]

THE PRESIDENT—The next business in order will be the nomination of Treasurer.

[A long silence, followed by continued applause.]

A VOICE—You have got to do it yourself, Storke. [Laughter and applause.]

MR. HIBBARD—In the absence of other nominations I rise to move the nomination of [great laughter]—well, you all know whom I mean. Will anybody second the nomination? [Renewed laughter.]

THE PRESIDENT—It is moved and seconded, I suppose, that the Secretary be directed to cast the ballot of the Association for our modest Treasurer, H. L. Storke, to fill the office for the ensuing year. All in favor of that will say aye.

Carried unanimously.

THE TREASURER—I rise to return my sincere thanks for the cordial and unanimous manner in which I was nominated. The Convention appears to be of one mind, and if silence gives consent, I am still your Treasurer. [Great laughter and applause.]

THE PRESIDENT—On account of the resignation of George N. Stone, of the Advisory Committee, there are two vacancies. The third member is Mr. M. F. Tyler, who holds over for another year. Nominations are in order for one member of the Advisory Committee for a term of three years, and for one member to fill the unexpired term of Captain Stone.

MR. E. J. HALL, JR.—I desire to nominate for the three-year-term Mr. W. A. Jackson. I was about to say of Detroit, but that sounds so much like introducing a man who does not need any introduction, that I will omit it.

The motion was seconded, and the Secretary was directed to cast the ballot of the Association for Mr. Jackson, which was done and he was declared elected.

MR. ULINE—I now move that Mr. A. W. Crandell be elected to take the place of Captain Stone.

The motion was seconded, and the Secretary was directed to cast the ballot of the Association for Mr. Crandell, and he was declared duly elected.

THE PRESIDENT—There are now four members of the Executive Committee to be elected. The present members are, Charles F. Cutler, Charles H. Wilson, H. N. Gifford, Levi Sprague, and the President, *ex-officio.*

MR. EASTABROOK—I would ask the Secretary if it is usual to elect these members of the Executive Committee in a body, or one by one ?

THE PRESIDENT—The Chair would state that the Association may use its pleasure about that. They may all be nominated and elected at one time or separately.

MR. EASTABROOK—I should like to place in nomination E. J. Hall, Sr., of Buffalo; Charles F. Cutler, of New York; Charles H. Wilson, of Chicago, and H. N. Gifford, of Louisville.

MR. CRANDELL—I second that nomination, and move that if there is any reason why we should not elect them at once that the Secretary be requested to cast the ballot of this Association for them.

MR. EASTABROOK—I will ask unanimous consent for that to be done.

THE PRESIDENT—There is nothing in the constitution or by-laws which prevents balloting for these four members at one time.

By direction of the Association, the Secretary cast one ballot, and the gentlemen nominated were duly elected members of the Executive Committee for the ensuing year.

THE PRESIDENT—What is the further pleasure of the Association? I may say that the Executive Committee have considered two or three papers which have been offered to the Association, and if there is no other business we will proceed to the reading of these papers. It was expected that the speech by the Mayor of this city and the little speech that the President had in response thereto would take up all the time of the morning session. The first paper is one prepared by Mr. Davison, of Brooklyn, and I would ask Mr. Carty to read that paper, as Mr. Davison is not present.

Mr. Carty then read the paper, which is as follows:

THE OPERATION OF THE DOUBLE CORD KEY-BOARD AT BROOKLYN, N. Y.

BY GEORGE J. DAVISON.

A year ago I addressed a somewhat extended report regarding the workings of the new multiple switch at Brooklyn, as then operated with the single cord key-board. On account of the troubles therein shown, and because it was essential that we should be able to operate mixed circuits in the multiple board, it was decided to change the key-board from the single cord, grounded system, to the double cord metallic. This change was completed early in March, 1890, and the new key-board has, therefore, now been in use for about six months.

The equipment is full metallic, with tubular clearing out drops, retardation coils, condensers, split telephones, etc., etc.

The change required the connection of answering spring jacks, which were placed horizontally in the lower part of the switch, necessitating the moving upward of all the spring jacks originally connected. This movement disarranged the switch cable wiring to some extent, and increased the liability to troubles in that particular, but very little has developed.

The wiring of the line drops had to be entirely renewed, they having been wired originally for grounded circuits only.

The number of troubles as shown by the table herewith is very low, and those occurring were almost entirely of a trivial nature, readily located and easily removed.

In the parts of the apparatus not referred to in the tabulated form, there has been scarcely any trouble. After the change of key-boards had been completed, new transmitter cords were put in, none of which have failed ; triple receiver cords were necessarily substituted for the double cords, only one of these having failed.

One of the condensers became short circuited, the result of which was to cause all grounded circuit lines to test "busy," whether in use or not.

The split telephones have been very satisfactory, no trouble whatever having been experienced in their use.

Spring jacks.—We have added 1,720 spring jacks to the 15 660 in use last year, making 17,380 now in use. For the first thirteen months' use there were ten cases of dirty contact ; for the past six months there have been twenty-two cases of this trouble. I think this increased percentage of trouble is due to a considerable extent to the disturbance of the switch cables at the time of changing the system, which set free whatever slight accumulations of dust there was in the cables, no small portion of which found lodgment in and about the spring jacks. None of the spring jacks have platinum contacts, the use of which would, I think, lessen this difficulty.

Drops.—There are 1,770 of these in use, an increase of 110 over last year's report. The troubles with these have been much fewer than was previously shown, comparing as follows:

	13 Months. 1889.	6 Months. 1890.
Catch	26	3
Shutter	36	8
Armature trunnion	203	None.
Crossed with core	6	1
Open in coil	2	1
Burned out	1	5
Broken wires	20	8
Total	294	26

None of these troubles require any special comment, the cause and remedy of each being apparent.

Ringing keys.—The ringing keys are of the pattern known as long-distance metallic, and there are 273 pairs, or 546 individual keys in use. Only five cases of trouble have developed, four of these being a failure to ring, caused by the generator springs not being properly adjusted, being so far away that the depression of the button did not close the contact between the line and generator springs. The remedy was easy and is obvious. The other case of trouble was where the button, being depressed, would not return to its normal position. This was due to a slight roughening of the sides of the wedge-shaped rubber plunger where the springs rest against it. A little oil applied at the point of trouble was all that was necessary.

Listening keys.—There are 273 listening keys in use with which there have been 41 cases of trouble, no one of which, however, was in the main line circuit, or interfered with the subscribers after a correction had been made. These 41 troubles may be divided into four classes, as follows: Failure to cut in operator, 9; failing to cut out operator, 1; rubber plunger sticking, 27; rubber pin broken, 4; total, 41.

Failing to cut in operator.—The nine cases of this trouble occurred in the first two months; and on account of the springs not having been properly adjusted when they were connected. The springs rested against the rubber plunger and did not close the contacts on the operator's circuit. There was no recurrence of the trouble after properly adjusting the springs by bending them.

Failing to cut out operator.—There was only one case of this trouble, caused by the rubber pin of the plunger being so short that the "throw" was not great enough to break the contacts.

Rubber plunger sticking.—This trouble occurred 27 times, and, as in the case of the ringing key, was where the plunger remained down when the cam was thrown forward. It was due to some extent to a lack of proper smoothness of finish on the wedge-shaped sides. The plunger is pressed upon by two springs on one side and one on the other, the unequal strain having a slight tendency to make it bind. The difficulty was readily overcome by rubbing a little oil on the sides of the "wedge."

Broken rubber pin.—Four of the little rubber pins which are acted upon directly by the cam became broken from some unknown cause. The cams of

the listening key make considerable noise when they are thrown forward, but I do not know how this can be avoided.

Tubular clearing-out drops.—There are 273 in use, which have required attention 23 times. All of these troubles, except two, were with the catch. The drops are located directly in the rear of and on a level with the cords, the plugs of which in being returned to their normal position occasionally strike against, and bend to some extent the rather slender catch of the drops, which in consequence fails to release the shutter. The remedy for these troubles, after their occurrence, is obvious. To guard against them, the drops should be located elsewhere, which, however, is not practicable in this switch. The "adjustments" referred to were where the armatures were too loose, requiring the changing of the position of the trunnion binding screws.

Cords.—It appears from the record that only about 35 per cent. of the cords in use had failed during the six months. As a matter of fact, the percentage of failures of the cords *actually used* is much greater. Each of the subscriber operators has 18 pairs of cords available, but habitually used a much smaller number, a half dozen or so pairs of cords being used for the greater portion of the connections, the other pairs in a lesser and lesser degree, according to the volume of business. There were a few failures of the cords at the point of soldering into the shoe, inside of the plug, but the percentage of troubles from this cause is very low. Almost all of the failures are just at the base of the plug, due to the strain upon the cord in withdrawing the plugs from the spring jacks. The breaking of the tinsels is increased considerably by the perspiration from the operator's hands penetrating the covering of the cords. It is the rule that operators shall withdraw the plugs by taking hold of the same, and not by the cord, but it is almost impossible to enforce the rule on long reaches.

The percentage of cord troubles in the double metallic is very much greater than in the single cord grounded system. In the 13 months' use of 1,200 single cords there were only eight failures, as against 209 failures in six months out of 576 in use in the double metallic. There are two prominent reasons for this increased percentage: first, because as there are two conductors in the metallic circuit cords, the liability to trouble is doubled in the same number of cords; and second, because in the double cord system the use of the cords is so much greater. In the single cord system a cord is not used except to complete the connections for which the subscriber, of whose line it forms a part, may call; while in the double cord system a pair of cords may be used any number of times, in fact, may be used almost continually. The one case of trouble, "conductors crossed in cord," was caused by abrasion of the insulating material. The effect of such a crossing of the line or test is that any grounded circuit subscriber's line tested with that pair of plugs would show "busy" whether in use or not.

Plugs.—The troubles with the plugs have not been many, amounting to 13 in all out of 576 in use. Four tips of plugs were broken off in the spring-jacks, due, however, more to accident and a lack of care than to faulty construction of the plugs. The removal of one of these tips from a spring jack is a somewhat difficult matter when it happens to be broken off when the plug is wholly

within the jack and the tip held fast by the line spring. It is then necessary to relieve the tension of the spring by partially or wholly withdrawing the screw holding it in place, and pushing the tip forward until it is within the sleeve of the "test." From this point, I find the most convenient plan of removal to be the use of a short piece of flexible rubber tubing; placing one end of the tubing firmly over the opening of the spring, a quick inhalation of breath rarely fails to bring it out.

Tips unscrewed.—The little rivet used to prevent such troubles has come out of nine plug tips, rendering it unsafe to use the plug until repaired.

Referring to last year's report, it will be seen that in the 13 months' record there were 459 cases of trouble with the combination key and 76 with the grounding jacks, a total of 535 in the single cord key-board, or an average of a little over 41 per month. The report herewith for six months shows troubles in the double cord key-board as follows: Ringing buttons, 5; listening keys, 41; clearing-out drops, 23; a total of 69, or an average of 11¾ per month. When it is further considered that about 40 per cent. of the troubles in the single cord key-board interfered with the subscriber's conversation after the connection had been made, and that not one of the double cord troubles interfered in this way at all, the contrast is very great. Add to this, too, the great difference in the ease with which repairs may be made to the double cord system, and that the making of such repairs need not interfere with the operator's efficiency nor with any subscriber's line, and it seems to me that there can be but one conclusion arrived at.

On motion, the thanks of the Association were tendered to Mr. Davison for his interesting paper.

THE PRESIDENT—Are there any remarks on this paper?

MR. LOCKWOOD—Mr. President, if I may be permitted to express the opinion upon the record which you gave utterance to in your preliminary remarks, it is this: That one of the reasons—or so it seems to me—for the scarcity of papers in our later meetings is the dearth of discussion which has taken place upon any papers which have been heretofore read. My experience in associations and various organizations is that the bulk of advantage which is gained is derived from full and free discussion. A paper of itself, no matter how praiseworthy or how replete with information it may be, is still necessarily incomplete unless it elicits the views of hearers who are well adapted to speak upon such subjects. I cannot refrain from expressing my own views in regard to this paper, that it is one of the most practical that has ever been presented before this association. It is brief, pointed, and full of information from

beginning to end, and has just such information as is valuable in our central office work. Some two years ago I visited Brooklyn, shortly after the single cord switch-boards were set up there, and I had the pleasure of meeting the author of this paper, and was much impressed with his ability and intelligence, and especially with regard to the attention which it was evident to me he bestowed upon detail. With the permission of his superior officers, I obtained a copy of a report which he made after a certain number of months' operation of this switch-board, which went through just such features and with just as much detail as the paper to-day has done. It brought out in a clearer and more conspicuous way than I ever saw before the immense variety of faults and evils which a central office switch-board is capable of developing. These are of course largely due to the complexity of the operations to be performed. When we consider the calls to be received from the subscribers, and consider also that the operator must ascertain whether any of the lines called for are already in use, and when we consider that the second subscriber must be called, and that the two lines are then to be united for conversation, and that the conversation must be largely guided and supervised, and that finally the disconnecting appliances are to be supplied—it is not surprising, I say, that this organism frequently gets out of order. It requires the most constant supervision of any electrical instrument that I know of, for many reasons. Each line has to pass through a great number of contacts, and necessarily so. The instruments for receiving calls have to deal with currents which are not strong, and sometimes which have to pass over unavoidably leaky lines, which cannot at all times be kept in the highest order of repair. The instruments through which the talking is performed—namely, the transmitting and receiving telephones—do not generate a strong current at the very best, and frequently it is a very weak one—the weakest, as we are in the habit of hearing, known, which is capable of accomplishing any useful result—and

therefore I say that the troubles which appear are not altogether, either in number or variety, greater than might have been expected if we stopped to consider what the current was, what we were dealing with, and of the very uncertain nature of all machinery, especially when it is worked to such a large extent as is a central office switch-board.

There was one other thing which also impressed me, and that was the very great improvement which took place this year in comparison with the year 1889. This I think shows constant supervision, and the paper corroborates my view, that there must have been constant supervision, in that the number of faults, and the number of ways in which faults have been detected, and a very large number of points especially connected with lines of flexible cords.

And so, Mr. President, it seems to me that the author of this paper deserves, not only a vote of thanks, but our heartfelt appreciation as well.

At this point the Vice-President was called to the chair, and President Sargent addressed the Association as follows:

I would like to say in regard to that paper, that while it may seem to members that it ended a little abruptly, the facts presented are so obvious to the writer that, in making that concluding remark, he supposed that everybody would see that the double cord switch-board which he had just described was so far superior to the single cord switch-board that he did not need to put it into words. There is far less trouble with the use of the double cord than with the single cord board. The trouble with the single cord switch-board is, in their removal they usually bring in other trouble and prevent the operator from doing the work properly, whereas, with the double cord board all these troubles may be gotten at and removed without interfering in the slightest degree with the efficiency of the operator. And I think the record shows conclusively that the use of the double cord—indeed, the use of a key-board that is entirely separate from the subscriber's wires—is the best.

MR. CARTY—I might say a good deal about the merits of the double and the single cord switch-boards, but as far as the market is concerned, there are no single cord switch-boards which are adapted for mixed circuits, and until we have one that is, I think it is beyond the range of discussion—that any discussion of the relative merits of the two boards until we get an extra circuit single cord board would not be very profitable. When an exchange comes to consider the question of a new office, the first question is whether the proposed board is adapted to a metallic circuit, and if it is not so adapted it is usually thrown out.

MR. KELLER—I would like to ask if there is a single cord switch-board in use in the United States to-day.

MR. LOCKWOOD—Yes, there is one at Columbus.

MR. WILSON—In answer to the gentleman's question, I will say that we have a single cord board in operation in Chicago in the main office, arranged for single wires and grounded circuits. We also have a single cord metallic circuit switch board in operation in the stock yards office in Chicago. It fills all the requirements for metallic circuits, but, as compared with the double cord metallic circuit switch-board, it has not been considered so good, on account of mechanical details. I would say also for the information of the gentlemen present, that we in Chicago had the metallic circuit problem to contend with, and we were not anxious to introduce any more experimental apparatus in our general system than we could help. So we took one of our branch offices to experiment with, and we have in operation in that office now five different metallic circuit key-board systems. The spring-jack part of the switch-board is the same in all of them, and, as the different systems dovetail together, we are able to operate the five different schemes in the same office. We have been doing that for six months or more, and from those five different schemes we have adopted one for use in our main office, and the apparatus is now being constructed for that. But the single cord scheme has had to give way for one of the double cord schemes, on account of the advantages of the latter over the former.

Now, I want to say that the part of the paper which has been read which interested me the most is the reference to troubles in the spring-jack. We found in Chicago, where we have long underground circuits, that the introduction of a small amount of resistance in the circuit makes a very great difference in the talk, and it is particularly apparent from those offices where the incoming trunk line business from the branch offices don't pass through the spring-jacks. The trunk lines end in cords and plugs. The outgoing trunk lines necessarily duplicate through the switch-boards, passing through 19 sections of the switch-board and 20 spring-jack contacts. If the contacts in the switch-board become dirty (not necessarily open, so as to interrupt the circuit entirely) we notice a difference between the incoming and the outgoing talk. We have found that a resistance of 200 or 300 ohms in a contact makes a very appreciable difference in the conversation. Some six months ago we organized a labor force to work every night on our switch-board, and the series of contacts through the switch-board have been measured with a galvanometer, and if a resistance exceeds 150 ohms—including the drop, which is 100 to 130 ohms—the spring-jacks are all cleaned. In that way we keep our service reasonably uniform. Our experience is that, after six months' hard work in cleaning up the contacts, we still have on an average from five to ten cases of trouble a day. That does not mean open contact. And I would like to ask if the statistics given in the report refer to open contact only, or to dirty contacts. If it is only open contacts, it might be consistent with our experience. If it is dirty contacts, where resistance of 200 or 300 ohms would be called a cause of trouble, why, then I cannot understand the difference between our experience and the experience east. In order to ascertain what the experience of other companies was, I arranged to get some reports from New York at one time and Boston, through the Western Electric Company, by the kindness of Mr. Barton. I was very much relieved to find that our troubles were less than theirs,

which I attributed to the pains we took every night to clean the contacts. But the report that we have before us now is so much superior to anything that I have heard, that I would like to have it explained, if there is any person here who understands exactly what the report means. I think that dirty contacts in the spring-jack in every large office is a very important and serious trouble. We have now 65,000 spring-jacks in our main office switch-board, and we are about to increase it to three times that number, and unless we can eliminate the cause of the trouble, we shall naturally expect just about three times as much trouble of that kind, and, as the number of spring-jacks increase on their line, the percentage of trouble to the subscribers must necessarily be increased.

MR. GIFFORD—I want to compliment the author of this paper, as well as the reader of it, and I want to express my pleasure for the information which President Sargent gave us as to why it stopped so suddenly. You remember, that about a year ago, in the middle of an eloquent address that I was making, I stopped very suddenly, [laughter,] and it helped me out of a point that I wasn't able to explain. I was speaking of electric lights and electric railway experiences, and suddenly discovered that I was trenching upon something I had better not discuss, and I thought that some time if I had the opportunity I would apologize; and, if, as Mr. Carty has stated, that was the cream of the whole thing, why, I think it may be esteemed that I was fraught with wisdom. He said it was unnecessary to say that, because of the wonderful wisdom of this Association. [Laughter.]

Now, in regard to this report of trouble, I think that the Brooklyn people ought to be congratulated on the small amount of trouble they have. Our trouble in Louisville, is that we have considerable dirty spring-jacks. We have a detached building that we occupy in the middle of a square. My wire-room and shop is underneath, but I have a floor very heavy, four or five inches thick, and very little dust

can get through, and when the janitor sweeps our room he sprinkles sawdust so as to avoid raising the dust; but in spite of all our precautions, we do have very dirty spring-jacks, and it has been the cause of a great deal of trouble. A subscriber will say that he cannot hear anything, and we first examine the battery. If we don't find anything wrong there, then there is a suspicion of a loose joint, or an old iron wire, and we go over those things carefully; and, if we find any tronble, it is removed. But then, after that is done, sometimes the thing won't work, and then we look at the spring-jacks. We find that a large percentage of our trouble with unsatisfactory service arises from those dirty spring-jacks. We had to go to work and clean out those little springs; a short time ago I detailed three or four employees to go through nights and clean out the whole switch-board. I tell you, you have got to go through and clean out your whole switch-board every month.

Then, too, we have had a great deal of trouble with broken cords. We have an exchange of not quite 2,400 subscribers. I find that we have from 25 to 40 broken cords every day, and, of course, they are a serious cause of difficulty. A man calls up for a connection, the operator connects him, and then he cannot hear anything. That is a very serious trouble. We have tried the ordinary tinsel furnished by the Western Electric Company, and then we tried a combination of tinsel and spiral wire. At last we concluded to have a cord made to suit ourselves, composed of about three times as much tinsel as is ordinarily put in, and that cord gives us a great deal of satisfaction. I have told my electrician to be just as extravagant as he likes in the use of cords, and to put in new cords of this kind whenever any cord is out of order. The most of the cords in the market is not any good, and, if our friend Barton can devise something better, he will receive the thanks of the whole fraternity.

In regard to the listening key, we have a great deal of trouble with those little hard rubber plungers. They get worn, they get dirty, and they are very hard to get at and

we have a great deal of trouble; and they are causing so much trouble that I was about deciding that I should have to go home by way of Chicago and see if they couldn't devise some remedy for it. The Warner lever there gives a great deal better satisfaction. I think we should call the attention of the manufacturers to these difficulties, and see if they cannot do something to remedy them.

MR. HIBBARD—I wish to mention it as a matter of observation in exchanges pretty much all over the country that the dirty jack trouble is more noticed in places West where they do not burn hard coal, and where the whole atmosphere is permeated with dirt and dust; also, in places where an exchange is located near a railroad yard, where smoke and soot from the engines float in through the windows. I think it may be possible that that is a reason why we do not have so much trouble with dirty jacks in Brooklyn as they have out in Chicago and Louisville. Why, in the Chicago office, if you enter it, you are at once impressed with the fact that it is a dirty office. [Laughter.] In Brooklyn, if a trouble occurred, I should say it was pretty likely to be an open, because there is not enough dirt floating in. The Brooklyn office is a neat, clean office—as clean as a parlor. It is a great deal cleaner than this room is. I don't think they even have to throw wet sawdust on the floor and tackle it with brooms afterwards either. [Laughter.] The Buffalo exchange has linoleum on the floor, and when they want to clean it they simply wipe it off. I think that is a feature that we should all pay attention to—that is, having clean floors.

MR. FARNHAM—Something was said about the noise of the listening lever in the paper. In our new Boston exchange we have provided against that noise by having the lever strike upon flexible contact instead of on a solid metal base. This I think has proved quite an objection in the listener key—the noise caused by throwing the levers up.

In regard to dirty jacks, I suppose we need to know whether that trouble is due to the corrosion or to the dust that gets

in between the springs. My opinion is that it is due to both. The question has occurred to me recently whether the lower contact of the spring might not well be trimmed with German silver as well as the spring itself. We have adopted the German silver spring. Would it not be a sufficient improvement and guard against corrosion if we used German silver there? Brass, we know, causes more corrosion than German silver.

There was a suggestion made two or three years ago in regard to freeing the switch-boards from dust, which I think has not yet been adopted, and that is to case up the switch-board on the back and supply a gentle current of air so that it would always be outward through all the crevices of the board, and dust kept out in that way. Then any little dust circulating in the room would never be thrown into the board, but would be kept out.

MR. WILSON—I will forgive Mr. Hibbard for his remark about the dirt in the Chicago office and pass over that very lightly. [Laughter.] It is a fact, however, that the main office in Chicago is very near the river, and the steamers going up and down the river emit a good deal of soot and smoke, which comes into our office; but we find a great deal of difficulty in all the small spring-jacks that have been reduced in size during the last few years for large switch-boards, and we don't find any trouble with any of the old jacks. All the new jacks have German silver springs. The difficulty seems to arise entirely from dust and dirt. The moisture in the atmosphere clings to the spring-jacks and the dust more readily adheres. The only relief for that that I have ever been able to discover is to have an inverted contact point; that is, inverted in the way we introduce the spring-jack. The difficulty is very pronounced, and, if the difficulty we have in Chicago is uniformly the same throughout, I think it would be worth the while of the convention to ask the manufacturers to do something to relieve us from the trouble. If nothing can be done, why I don't see any use in discussing the subject any further.

DR. CULBERTSON—Mr. President, I have a few thoughts about this subject that I will express. We have 12,352 jacks in use, and during the months from January to July we had 27 cases of dirty contact. As to cords, we are using the double cord, and we have had more trouble than in Brooklyn. We had from 43 to 94 per month, making a total of 387 cord troubles. We had a total of troubles during the seven months, of jacks, cords, transmitter, telephone and connecting cords, and key trouble, of 636. Our key troubles amounted to 202. They were mostly from dirty points of contact. We have the Warner key on our board, and it has been in use over two years. During the greater part of the past seven months we have been putting in new sections and making changes in our key-board, and that probably has been quite a source of this trouble, because the general taking care of the board has been to some extent neglected. The Brooklyn board is entirely new, having been finished in March, I think; and besides, Brooklyn is a much cleaner city, as our friends have stated. When that board gets older it is a question whether they will not have more trouble than they are now having.

(The following table was handed in by Dr. Culbertson, to illustrate his remarks.)

RECORD OF SWITCH TROUBLES AT BUFFALO, N. Y.—DOUBLE CORD WESTERN ELECTRIC MULTIPLE, DROPS 1,544; SUB'S 1,887. JANUARY 1 TO AUGUST 1, 1890.

MONTH OF 1890.	SPRING-JACKS IN USE, 12,352.			CUT-OFFS IN KEY-BOARD. KEYS IN USE, 170.						CORDS IN USE, 340.				Condenser short circuited.	Receiver Diaphragm rusted out.	Grand Total.
	Dirty Contacts.	Poorly Soldered Wires.	Total.	A	C	D	E	G	Total.	Cut-off at H.	Transmitter.	Telephone.	Total.			
Jany..	9	....	9	..	..	..	2	2	4	45	..	..	45	...	...	58
Feby..	4	2	6	..	1	..	6	41	48	63	..	..	63	...	3	120
Mch ..	5	....	5	1	3	4	24	32	64	51	..	..	51	...	2	122
April..	2	....	2	1	..	..	12	22	35	44	..	..	44	...	..	81
May ..	6	....	6	..	..	..	....	21	21	43	..	..	43	1	...	71
June...	1	1	2	..	1	..	2	11	14	47	2	..	49	...	...	65
July ..	...	....	....	..	..	.	3	13	16	94	1	7	102	...	1	119
	27	3	30	2	5	4	49	142	202	387	3	7	397	1	6	636

MR. BARTON—I desire to bring the attention of the Association for a moment to the general question of two cord or one cord. The question of spring-jack contacts is an important one, and it will require attention from members of the Association in the future as well as from those who have to do with the manufacture of boards. I don't wish to say anything to abate from the satisfaction of our Brooklyn friends with their switch-board. There is nothing that I could say that would avail to lessen their satisfaction with it. [Laughter.] I wish to draw attention, however, to the fact that it does not follow, because they had a certain number of troubles with their single cord board and a certain less number with their two cord board, that the troubles, or absence of troubles, are due to the single cord or the double cord. The fact is that the single cord board which was put in in Brooklyn had key tables, in which the apparatus was considerably crude in detail, and the difficulties, as I have read in the report which was presented at Minneapolis last year, were very largely due to the crudeness in the details of that board. Now, if Mr. McKinstry, in his Cleveland single cord board, has as many troubles with the subscribers as they had in Brooklyn, why, then there would be a chance to make a comparison of the systems, because between the time when the Brooklyn exchange was equipped and that of Cleveland there was a good deal of advancement made in the details of construction. The proper way to reach a clean basis on statistics of trouble would be to compare the present Cleveland board with the present Milwaukee board, or the Thirty-eighth street, New York, board, or the board that has just been opened in Denver. The Cleveland board embodies a pretty good degree of excellence in details of construction. The same degree of excellence has been applied in the single cord boards in use by the German government in Berlin, and those boards I think are fairly satisfactory.

I do not propose to enter into a general discussion of the advantages of single or double cord, as it is a very large

question and there are a great many things to be said both ways. The present tendency of the judgment of the experts in this country is in favor of the two cord key table, but I do not think that should be entirely on account of the trouble to be found with either system of key table, because those troubles depend largely on the perfection in planning and in the manufacture of the apparatus, and the real question as between single and double cords relates to other considerations.

In answer to the question of a gentleman here awhile ago as to whether there are any single cord boards in use in the United States, I would say that there are a considerable number of such boards; among others, the principal exchanges in Cleveland, one in Cincinnati, one in Providence, one in Columbus, one in Portland, Oregon, one in St. Joe, Mo.; one in Topeka, one in Los Angeles, and perhaps others which don't occur to me at this moment. Those boards are tolerably well liked, I think, by those who have them. There is (so far as I know, however, with the exception of the one which has been mentioned as in use, in a certain sense experimentally, in Chicago—that is, for the purposes of trying it) no switch-board on the single cord system, and with the best equipment for metallic circuits.

MR. HIBBARD—I think it would appear from what has gone before that Mr. Barton's very last remark covered the whole question. As I remember it, the prime reason for changing the Brooklyn board was, not that it had been ordered out of operation, as it was then in operation, but that it might be enlarged and made capable of having metallic lines instead of single wires. So far as I have heard, the only reason that Chicago takes the double cord system is the fact that the detail of handling metallic lines has not been worked out in its application to the other systems. I think Mr. Wilson was as firmly wedded to the other board then as anybody is. I don't think his record of troubles in his main office shows that there is any inherent difficulty in operating his office on that plan. However, in

order to change his system and to put his wires into cables largely, and operate metallic instead of grounded lines, it is my opinion that they have been obliged to take these other systems. Therefore, a comparison of the system which is applicable only to the old method of operation is a question which is not in the discussion.

A MEMBER—Mr. Wilson expects to handle grounded circuit wires also with his circuit, doesn't he?

MR. HIBBARD—Yes, sir.

MR. WILSON—I would say that we have in Chicago nine offices, all of good size. Our largest office accommodates 3,000 subscribers. The switch-board is filled out and we have started an annex office that has now 250 subscribers, and we are awaiting for additional equipment. Of course, in putting in additional equipment, we are providing for metallic circuits. At the time the switch-board was constructed in the main office there was no metallic switch-board at that time which we were willing to accept. We have been experimenting with a view of altering over the switch-board for metallic circuits. It is not a very considerable job to do it. In deciding upon a new system, the points of excellence between the different systems to be considered were principally those of contact. The system which had the lesser number of contacts in the circuit and had the most workmanlike apparatus, for which we depend on the manufacturer, was the one adopted. In regard to the comparison of our one cord switch-board with the Brooklyn board I will say that the principal objection which I understand was made to the Brooklyn board was this, that if a cord became out of order the subscriber's line was temporarily interrupted. In the Chicago board that was not the case, and in that sense the Chicago one cord board is not strictly speaking a one cord board. It has the one cord feature, which is the primary feature of the board, but we also have enough double cords overhead to relieve that one cord when it becomes out of order, and we never had that difficulty. It is a very simple thing for the operator

to discover when the cord is broken if he will simply tie the cord in a knot and hang it above the operator and use the overhead cord. We never considered that the one cord board without a few overheard cords was a good thing. The answering is done by the insertion of a plug in the spring-jack. We consider the spring-jack the best piece of mechanism that we had at that time. When we could substitute a spring-jack for a cam lever key we did so. Aside from our dirty spring-jacks, we had less trouble in proportion to the size of that switch-board than any board I knew anything about in the country; but when we undertook to change our system from metallic circuits we considered the same features that we did when we put in the one cord switch-board. We found that the one cord metallic circuit switch-board had more contact in it than the two cord system which we adopted. From experience we have formed a prejudice against cam lever keys, and we don't propose to use any. We have a new key that goes into the board like a spring-jack. It has all the features of a spring-jack in it. We have had those keys in operation now for over six months, and never had a single case of trouble with them. We have had the Thirty-eighth street system in operation alongside of the system which we have adopted, and, we think, that our experience is positive enough to adopt what we call the Chicago system.

MR. LOCKWOOD—In addition to the present inapplicability of the single cord, it seems to me that there is one other consideration which Mr. Wilson has hinted at, when he says that if a cord gives out they would knot it and leave it out of use for the present and use the overhead cord. It appears, then, that the most fragile portion of their circuit is a portion of every line with single cord boards, while it is only a series of links in the double cord switch-board. That of itself seems to me to be a consideration which should weigh very heavily with all in considering the matter. There is also a word about the location of exchanges on the eastern seaboard that I would mention. One of the greatest

troubles is the moist and saline condition of the atmosphere, which, of course, brings in quite a different class of trouble than the carbonaceous trouble in western cities where they burn soft coal. That material which seems to interpose itself in the contact system in the western cities is carbon that floats in the atmosphere. It was my fortune to be able to prove that in a remarkable way at one time. I had to stop over some hours at a little station on the Erie Railway, and I went into the telephone office, and, in the course of some conversation with the operator, she said there was one line that wouldn't work. I looked at it, and I loosened the spring-jack down a little, and I found I could actually use it as a transmitter, there was so much carbon between the points that it would really work as a transmitter.

Now, I have found another trouble with spring-jacks. Some months ago I had occasion to spend a couple of days in Albany, and I found that one of the spring-jack troubles there was not dirt or carbon between the points, and it struck me that perhaps some of the trouble which has been ascribed to dirt was really due to the trouble they had there—namely, that the insulated contact screw in the lower part of the jack had been made with such a sharp point that it made a dent in the screw in the spring above, and by-and-bye that depression was made so deep that when the foot was taken out it was all that the spring would do to make contact with the screw point at all. This, of course, depends largely upon the material used, and in this case I may say that the material was not brass, but it was German silver, and, as there are different grades of German silver, of course we should be careful and get the proper grade.

The Vice-President again took the Chair.

THE PRESIDENT—Referring to Mr. Wilson's question, I would remark that I think the troubles referred to are the troubles made apparent by connecting subscribers with each other. There is a rigid system of inspection with all parts of the apparatus, at regular intervals, in Brooklyn. In regard to the change from single to double cord switchboards the change was made, not on account of the trouble,

but on account of its not being adapted to the mixed system of metallic and grounded wires. Our metallic system is increasing very rapidly. I will say that I have introduced these papers for the very purpose of contrasting the two systems, and to bring out the faults that they may have. The key-board is the most important part of the switch-board. It is in constant use and wear, and requires renewal very frequently.

In regard to the dirt between the contacts of the spring-jacks, I have no doubt that climatic conditions do affect the spring-jacks to a great degree, so that different cities will obtain different results with the same apparatus. I think it is better in large central offices to have a hard-wood floor. It can be more easily kept clean. It is much better than a carpet, or even linoleum, because there is less chance for dust to accumulate. We have never had any carpet or rugs in our operating room.

The opinion we have formed by the trial of the two key-boards, is that, taking all the conditions of the business, the double cord system is the best; that with the single cord system, doing the best you can with it, it is so crowded and it is so difficult to remedy trouble that occurs in the midst of busy hours, that that fact alone is enough to condemn it.

Mr. Wilson's recommendation of the single cord board is something like that of the cripple who has become very expert with his crutches, which, in this case, are the double cords, which he used when the single cord failed; but no cripple would be willing to continue the use of his crutches if he could use his legs. I do not think anybody wants to use a single cord board if they have got to have a double auxiliary key-board to keep it on its legs.

MR. WILSON—I see that I must defend myself again. I don't entirely agree with President Sargent, that the single cord board is to be considered in the sense of a cripple; although it is now, in view of the introduction of the metallic circuit. The advantages in favor of the single cord system are just as apparent to-day as they ever were.

In the first place, you have only half the number of cords in use. Instead of using two cords to make connection, you use one. One great advantage for instance is that, when a case of cord trouble is reported, we know exactly where to find the defective cord; and you don't know that in the case of a two cord board. For instance, if you have a defective cord and it is not sufficiently defective, so that the operator discovers it when she rings, why, that interruption will pass around over half a dozen or perhaps twenty subscribers before it is discovered. You get a complaint in the office of cutting off and unsatisfactory service, and you know from the nature of the complaint that the trouble is in the cord. Well, you get the number of subscribers that were connected in that particular complaint, and you know then which group of cords was used, and you examine them and see if you can find the trouble. But you may not be able to find it, especially if you use tinsel cord. Now, with the one cord system, if you get a complaint of that kind, we cut the cord off and repair it, whether we find the trouble or not; and in nine cases out of ten, if an examination is made carefully, the trouble is found much more easily with the one cord system. But I do not want to be understood as advocating the one cord system for metallic circuits, because I am not. But if I was going to equip a new office—which I am doing all the time—in our small exchanges, why, I would use the one cord system. We use the one cord system altogether for metallic circuits in small exchanges, where we have multiple switch-boards. The advantages are that we equip those switch-boards just as we add subscribers. For instance, we have a small exchange with ten or fifteen subscribers. We add the complete equipment for each subscriber. We keep run of the cord. If the cord becomes defective in those switch-boards we simply use the other cord, and we have the same advantage as we have in our main office with the two cords that are used in emergencies. We are increasing the number of our private exchanges in Chicago rapidly—that is, a sort of

combination of speaking-tube lines—and we use what we call the single cord system. Every subscriber's line has a cord. It is double cord in the sense that it is arranged in a metallic circuit, but the two cords are under one cover and have only one plug; and we think we can see the advantages in it. It is the cleanest and nicest equipment that we have without any cam lever keys, or anything of that sort, and wherever we have those small switch-boards in operation they give complete satisfaction.

In case some gentlemen here may not understand what I mean by private exchanges, I will say that we have quite a number of subscribers--like, for instance, the Illinois Steel Company, which has its general office in Chicago, with about twenty telephones in use. They have three rolling mills in and around the city, and they have lines connecting them, and we run all those lines into the private exchange located in their general office, and we give them three trunk lines from that switch-board into our office. We call that a private exchange. We make them a special rate, of course, for that service, and then the telephones in their general office are connected out in such a way that they have what we call the speaking-tube service. That is, they don't have to call their operator to get that service. We are putting in quite a good many of these outfits. Armour & Co. have one like that. The Milwaukee and St. Paul R. R. Co. have one, and we are now connecting the Wisconsin Central R. R. main office with all their branch offices in the city. The subscriber in such cases as these becomes the Company's agent in the transaction of that business, and the deduction they get in rates is the compensation we pay them for handling the work. They pay regular rates for everything, and we pay them so much for operating the private exchange. In all those places we use the one cord system, and prefer it to the two cord system. If I were going to equip a large exchange with metallic circuits, I would use the two cord system.

MR. E. J. HALL, JR.—I think, Mr. President, that we some time ago passed the hour for adjournment for dinner, and I move that we adjourn.

MR. GIFFORD—One moment before we adjourn. This is the tenth anniversary of our Association, and we have got along very nicely thus far; but at this late hour I am very sorry to see any spirit of jealousy, and I feel as though I ought to call attention to Mr. Hibbard's remark concerning Mr. Wilson. [Laughter.] I want to do it kindly, and don't want to hurt Mr. Hibbard's feelings; but his allusion to the dirty office in Chicago I perfectly understand; you see, he has recently left Milwaukee—which is a rival of Chicago—and has gone East beyond the region where they burn soft coal. Now, Mr. Hibbard said that Mr. Wilson was wedded to a switch-board. That is a mistake. He may have his preferences, but the fact is that Mr. Wilson was wedded to a charming lady from St. Louis about a year ago, in proof of which, I am reliably informed, that there is a fourteen pound young Wilson recently arrived in Chicago. [Prolonged laughter.]

THE PRESIDENT—Those in favor of adjourning will manifest it in the usual manner.

The Convention then adjourned until 3 o'clock.

AFTERNOON SESSION.

THE PRESIDENT—Gentlemen will please come to order.

MR. EASTABROOK—Is there any regular order of business at this time?

THE PRESIDENT—No, sir; except the reading of papers.

MR. EASTABROOK—Then I would move at this time that the opening of to-morrow morning's session be the time designated for the choice of a place for holding our next annual meeting, as I believe it is only fair that any interests to be heard should have warning at what time that matter will come up.

The motion was duly seconded and carried.

MR. BEACH—There seems to be some misunderstanding as to the standard of time in reference to the coming together at these meetings. I would suggest that we adopt the local time. This morning there was some misunderstanding—or lack of understanding, rather—as to whether 11 o'clock was meant to refer to the local time, to Eastern standard time, or central standard time.

THE SECRETARY—Let us compliment the City of Detroit and be governed by the local time.

On motion of Mr. Hall, duly seconded, the time for calling the meetings together was fixed to conform to the local time.

A MEMBER—Well, Mr. President, what time is it in Detroit now? [Laughter.]

THE PRESIDENT—I wish you wouldn't bother the President with conundrums of that kind. I do not assume any responsibility, but the Secretary says it is now eighteen minutes of four. Well, gentlemen, that matter being disposed of, and there being no other motion to discuss, we will proceed to the reading of a paper by Mr. E. J. Hall, Jr., on the subject of "Corporate Organization."

Mr. Hall then read his paper, which was as follows:

CORPORATE ORGANIZATION.

BY E. J. HALL, JR.

Corporations have been called "artificial persons," owing their existence to the creative power of the State, and designed by process of law with more or less skill to approximate natural persons in their powers and duties.

When the legislative powers are exercised wisely and skilfully, and these artificial persons have been properly constructed, they take their place in society as most useful members, serving the needs of the public in many ways with far greater efficiency and reliability than any natural persons possibly could; for while it may be true that corporations have no souls, it is equally true that they are not subject to paralysis or indigestion.

On the other hand, their design being subject to the fancy of legislative bodies, these artificial persons are sometimes over developed in some directions and lacking in others—the builder who follows the legal specifications, often finding that parts essential to some material function are wholly omitted, while others are so dwarfed or magnified as to be out of proportion to the symmetry of the intended design.

In the early days of these new members of society the natural persons then composing it had a feeling of, perhaps, not unnatural alarm that if these artificial persons became too big or too numerous they might be troublesome neighbors. What, for instance, if the power which gave them legs and arms should take a notion to add cloven feet, horns and a tail.

This has, from time to time, occasioned the introduction of various restrictions into the specifications, some of them doubtless wise, others unquestionably unwise ; but with a realization of the fact that society had not lost, and could not lose, the power to protect itself, has come a better understanding of the benefits to be derived from properly constructed corporations and a disposition to formulate the specifications so that their construction shall be encouraged and their capacity for work utilized to the fullest extent by society.

The tone of the press during the recent labor troubles on the New York Central Railroad reflects a marked change in public sentiment from that existing even a few years ago, and, to some extent, this change is due to a better understanding on the part of corporation managers of the obligations which rest on them to so organize their forces that the public shall be efficiently served, stockholders receive proper returns, and last, but by no means least, that employés shall be justly compensated and fairly treated.

To organize and conduct a corporation so as to fully meet all these obligations is no easy task. In my own work I have been greatly helped by making diagrams of any proposed arrangement of forces, for the purpose of studying from that the exact relations which would exist between various departments and employés if the plan were carried into effect.

Almost invariably the study of a diagram brings out unexpected defects of arrangement, or suggests changes which would improve the efficiency of the force. President Sargent has asked me to explain this diagram system, and I am glad to comply with his request, because I believe there is for us no more vital problem than the best method of constructing the "artificial persons" who are furnishing the public with its telephone service, but for whose actions we are all largely responsible.

I do not see why we should not go at this just as we would at the construction of any piece of mechanism. Surely it is more complicated and more delicate than any of our electrical apparatus, and at the same time, its motions are attended with such consequences that we cannot afford to make any mistake.

When we undertake to prepare plans and specifications for the construction of an "artificial person" to conduct the business of a telephone exchange, we must look, first, to the statutes of the State, in which we will find the legal specifications. From them are prepared the charter or articles of incorporation, which in a general way define the nature of the proposed corporation and the position which it desires to occupy in relation to the State; while the By-Laws, which are to some extent controlled by statute, provide, generally, for the relations of the corporation with its stockholders.

By the articles of incorporation and the By-Laws, provision is made for the control of the corporation by trustees or directors, elected by the stockholders

and by certain officers, usually a President, Secretary and Treasurer, elected either by the stockholders or by the directors. These officers are common to all corporations, and are charged with certain duties by the State and by the By-Laws.

It would be interesting to go more fully into the relations thus established between the new corporation, the State which gives it being, and the stockholders who risk their fortunes on its success. We will not, however, stop to do so now, because we are considering to-day only the executive forces, the *physical structure* of our "artificial person." The functions of the officers named will be considered only, as they relate to the performance of the work for which the forces are to be organized.

The unit of work, that is the amount which can be performed by one person, is very small, so we must sub-divide until each part of our work receives its proper share of attention ; but, as all of the parts are inter-related, it is evident that there must be somewhere a single central authority, or division means chaos. From this central authority there must be a direct line of communication to every department and every employé ; no matter how many departments or employés there may be, this line must be kept in good working order, free at all times from breaks and crosses.

To carry our simile of the "artificial person" a little further: When in a natural person the stomach wires the brain for supplies, the feet must receive orders to move in the proper direction toward them, first one, then the other; they cannot be left to argue between themselves as to which shall move first ; then the hands must do their work, and at the right moment the mouth must be ready to do its part ; and so each member performs its office as the orders are sent over the connecting lines, and reports from each keep the brain constantly advised of the manner in which its instructions are being carried out.

To construct a diagram of these lines of communication will help us to see how best to arrange the various parts of our artificial person to secure as exact results.

For convenience we will call this main line the "Line of authority," and extend it unbroken from the management to each employé. Other lines there may be and must be to unite all the parts of our mechanism into a complete working body, but they must never be mistaken for or tangled with the line of authority, or confusion will follow.

On the diagram which I have made we can trace now the line of authority, originating with the stockholders, extending to the Board of Directors, then to the President, then to the General Manager, and dividing at that point, branches extend to each department chief, and through him to his subordinate officers, superintendents, managers, foremen and so on until it reaches the last messenger boy.

The General Office is particularly the department of the General Manager. Its work consists, *first*, in receiving and recording the orders of the President and directors and transmitting them to the proper persons for execution. With the orders must go the funds and materials for carrying them into effect and the details of the methods to be followed. *Second*—To the General Office must

come back the reports and results of all work, which must be recorded and transmitted in proper shape to the Directors. *Third*—Through the General Office all arrangements must be made for *transfers* from one department to another.

The General Manager acts as the connecting link between the authority which shapes the plans and controls the policy of the Company and the forces which carry those plans into effect. He should be identified as closely as possible with both, and this is often accomplished by making him a member of the Board of Directors, thus enabling him to fully understand the nature and results to be accomplished, while, at the same time, his close relations with the working forces enable him to keep the directors fully informed as to the condition of the Company's plant and forces—their possibilities and needs for the accomplishment of any desired result.

The General Manager, as the diagram shows, has no authority over the Secretary, Treasurer, Auditor or any employé on the President's line, but such relations as are necessary must be established by order of the Directors or the President, unless, as is often the case, the General Manager is also Vice-President, in which case his relations are established by the *latter position*.

This distinction is important, and it applies equally in the case of all relations between officers and employés of different grades when one person fills two offices not on the same "line of authority."

The General Manager should be responsible for the appointment of all employés on his staff or below it, but it does not by any means follow that he should in person select all individuals for appointment; on the contrary, holding a veto power over all, he should select none but his personal assistants and the heads of departments, for the same reason which makes it necessary for him to control all appointments makes it necessary that—following the line of authority and conversely of responsibility—each other officer should, so far as possible, hire and discharge all for whose efficiency he is immediately responsible.

Just here I want to point out the error into which all of us who have charge of a number of men are apt to fall: that is, of doing too much detail work; too much *work* I was about to say, but it is the quality not the quantity generally at fault. It is often so much easier to do personally than it is to teach others that we fall, often insensibly, into the error of doing routine work which others can do as well or better; and having filled our day with arduous labor go home at night tired but satisfied that the day has been well spent, when as a matter of fact we have perhaps lost sight of our duty to keep track of and direct the work of others, and have performed the work of a junior clerk while the interests committed to our charge have suffered in all directions from neglect.

The functions of the construction and operating departments with their various sub-divisions are so well understood by all that it is unnecessary to go into details, and we will follow quickly along the line of authority through the office of the general superintendent to the linemen on one side and on the other to the operators and messengers.

Now to pass from one point on the diagram to another we must follow back and around on the established lines. There must be no cross lines of authority established, or immediately there is a division of responsibility. This does not mean that there are to be no direct relations between officers and departments except over the route of the lines of authority. On the contrary, as I have already said, there must be almost innumerable "lines of relation." These lines may be established in two ways. First, by order of some common superior authority, and second, by an understanding between the employés concerned.

For instance, by order of the President the Treasurer might be authorized to use office managers to collect certain accounts or pay certain bills. The treasurer would then have a line of direct relation established with each office manager, but the authority would originate with the President, and his order would pass through the hands of the General Manager, General Superintendent and Superintendent of Exchanges to the office managers. Authority given to the Treasurer to employ the managers would always be given with the tacit or expressed understanding that the regular duties of the employé called on should not be interfered with, and that the employé's first duty was in every case to his immediate superior.

As an instance of the second sort, it might be arranged between the Construction Department and the Equipment Department, that one would do certain things in connection with the other's work; for example, that the Equipment Department would hang a cable which the Construction Department was responsible for hanging. The test of this transaction would come in case of failure to carry out this understanding. Would it be any excuse for the Superintendent of Construction to say that the Superintendent of Equipment had promised to hang the cable and had failed to do it? Certainly not. The diagram shows how such an arrangement could have been made by authority. He took the chances of an arrangement under which he had no control over the other party, and he accepted all the responsibility.

In a bad organization this constant shifting of responsibility is always found, and the blame should be with the organizers rather than with the employés, who are probably doing the best they can with a faulty system.

Another fault always found in a bad organization, is a defective method of giving orders. Sometimes, an organization that would otherwise be good is demoralized in its work, by a careless habit of giving vague verbal orders—a practice sure to result in confusion.

Whenever practicable, orders should be given in writing; they should be brief and clear; and whatever is to be left to the discretion of a person carrying out an order, should, if possible, be so stated. Advice and suggestions may be verbal, and often are better so. When an order is accompanied by advice or suggestions as to methods, care should be taken to so separate the order and the suggestions that there may be no misunderstanding.

When verbal orders of any importance are received by any employé, he should take the earliest opportunity to reduce them to writing, and send an acknowledgment of them, explaining his understanding of their nature to the officer from whom they were received.

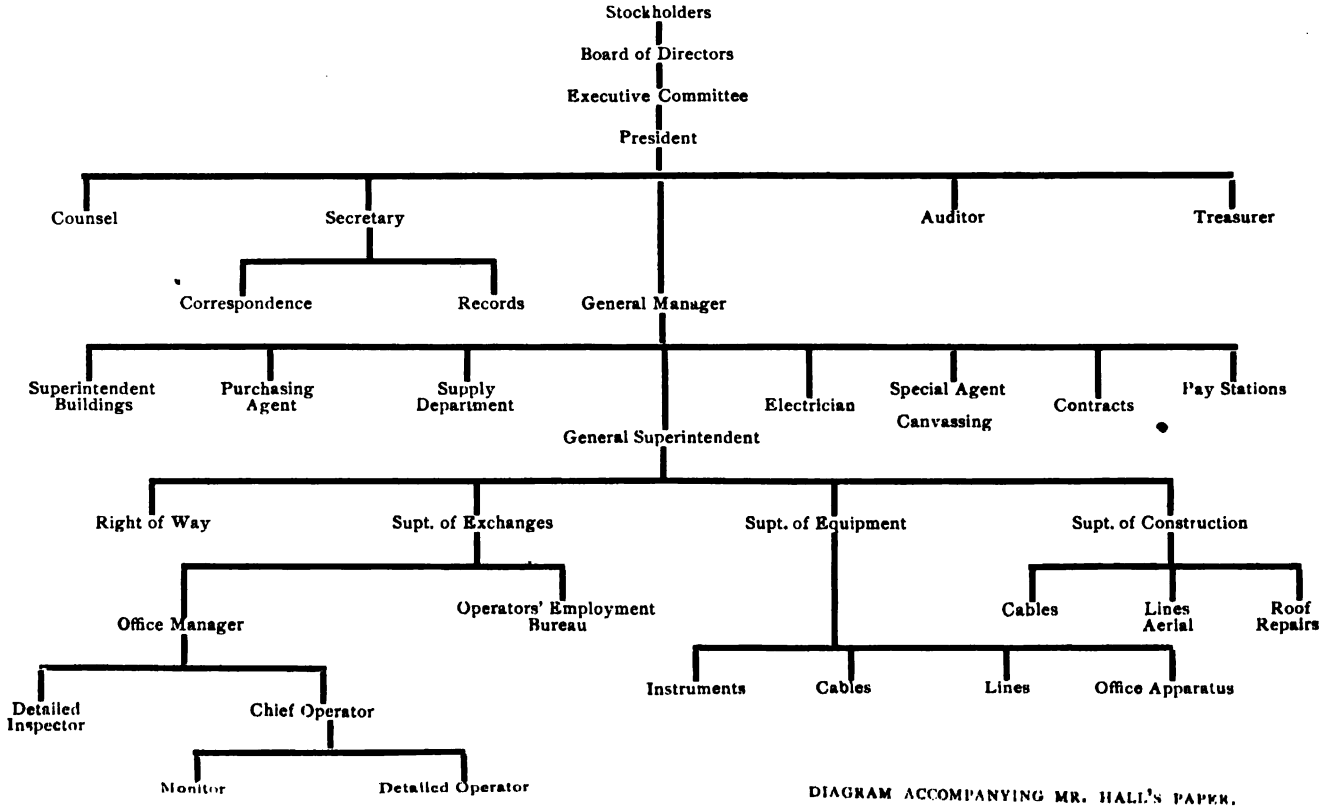


DIAGRAM ACCOMPANYING MR. HALL'S PAPER.

The chart which I have made shows substantially the general organization of a large company, but one which operates a comparatively small territory. Of course, a chart prepared for one telephone company or exchange, would not be suitable for all others, or perhaps, for any other; but there are certain functions which are common to all, and modifications can easily be made to fit all conditions.

The key-note of all successful organizations is sounded in the Bible words: "No man can serve two masters." In the abstract we doubtless all agree with this, but in practice we often make discord instead of harmony among the delicate strings which bind our forces together. It is easy to say that we will arrange our forces so that no man shall serve two masters, but it is far from easy to do it. Especially is it difficult in a small company, where the number of men must necessarily be limited, but where the manifold duties of the service must still all be performed. Even in the larger organizations it is far easier to cross and tangle the lines than it is to keep them straight. The diagram system will aid the manager of a small company to arrange his men to advantage, while to the manager of a large company it will act like the "deadly parallel column" in the newspaper, pointing out all inconsistencies between theory and practice.

Our work of organization and administration is, under the most favorable conditions, perplexing and difficult. Lines must be built, offices equipped, apparatus designed and constructed, records kept, rights of way obtained, reports made, supplies purchased and taken care of, problems—legal, financial, scientific and practical—solved, and withal we must reckon with human nature in all its varied forms. Each unit of the vast aggregation must be placed where it will be most beneficial to the whole, and yet each be so dealt with that personal pride and self-interest shall be considered; faithful service and capacity duly rewarded; the ignorant educated, the idle punished, the vicious and incapable eliminated; and over all strict discipline, tempered with sympathy and kindness, maintained. Only a thorough organization, wisely administered, can accomplish all this. Without organization the ablest will fail, and without it the best will often fall far short of their ideal.

When we have constructed our "artificial person" from drawings which clearly show the location and relations of all the parts, and from specifications which define in exact language the function of each, it may still lack much of the perfection of the natural person; but I am sure it will do its work with far more efficiency and vastly less disturbance than if it be simply an aggregation of unrelated parts tangled together by the old-fashioned "rule of thumb" method.

THE PRESIDENT—Gentlemen, you have listened to the reading of the paper by Mr. Hall. Are there any remarks?

MR. HALL—While this diagram is applicable to the general organization of a company, I asked Mr. Carty, who is interested in this, to make a diagram showing how he,

in following out this line of thought, has organized the department for which he is responsible in his own company; and starting in, as you see, at the "Superintendent of Equipment" in the general scheme, he has arranged a diagram of the force which he has under his control, and I think it would be interesting to have him explain how he has utilized this idea before we take up the matter for general discussion.

MR. EASTABROOK—Before proceeding to that, I move that Mr. Hall's paper be accepted, with thanks, and printed in the proceedings of the Association.

The motion was duly seconded and carried.

MR. CARTY—This diagram on the wall represents one of the departments of the Metropolitan Telephone Company. The Superintendent of Equipment is responsible for the condition of the plant. A report of any trouble with the wires, cables or apparatus in a subscriber's office, or in a central office, comes to here [indicating]. This is the Chief Inspector here [indicating], and he has under him, first, a foreman of inspectors, who gives out the daily work to the inspectors who visit the subscribers' stations. The duty of an inspector is to go to a station and see that it is in order, make a note of what condition he finds it in and what he has done, and hand to the subscriber a printed slip which has on it a request for the subscriber to inscribe on the back of the slip any fault he may have to find. This foreman inspector has a large detail of men under him, and he is responsible for seeing that his men do their work properly. Then, for taking care of the trouble, there is located at each of the various offices what is called a "wire-chief." For instance, at Cortlandt street we have a man who sits at a desk called the "trouble desk," and who is equipped with all the necessary apparatus for locating the trouble. If the trouble at any one of the various stations becomes greater than the ordinary staff can properly take care of, the wire-chief at that station communicates with the Chief Inspector and the detail is increased; or, on the contrary, if he gets

his work up in good shape, he reports that fact and the men are transferred somewhere else. The Superintendent of Equipment receives from the General Superintendent the orders to put in an instrument for a new subscriber, and that order is turned over to the chief wire-man, who gives it to his foreman, and the job is assigned to a particular workman. The chief wire-man also sees that the line is cut in at the cable terminal and at the subscriber's station. So that the task of getting the line working is in the hands of one man, and when the line is connected up in working order the chief lineman sends the order back through the Superintendent of Equipment to the General Superintendent, and a record of it is made on the books. When a new subscriber is put in at Thirty-eighth street, for example, the representative of the equipment department there has to receipt for the information relative to that subscriber. For instance, he receives a slip and makes a note of the cable conductor that that subscriber occupies, and all the other data necessary to go into the record. So that at Thirty-eighth street there is a complete record of all the terminals ending there and all the subscribers, and no change can take place without going through the Thirty-eighth street wire-chief. A similar record is kept at each of the branch offices, and a record of the entire city is kept by the Superintendent of Equipment.

This scheme is not thoroughly completed in New York, but as far as we have got, it has been of the very greatest assistance. It completely divorced from the operating department all responsibility for the plant. If the trouble should occur to a subscriber's office in the Thirty-eighth street station, a notice of that would find its way to the office of the General Manager, and it would be forwarded to the representative of the Equipment Department located at that office, and called the "wire-chief." Any ordinary trouble would be first known by the Superintendent of Equipment, as a notice that it had been attended to.

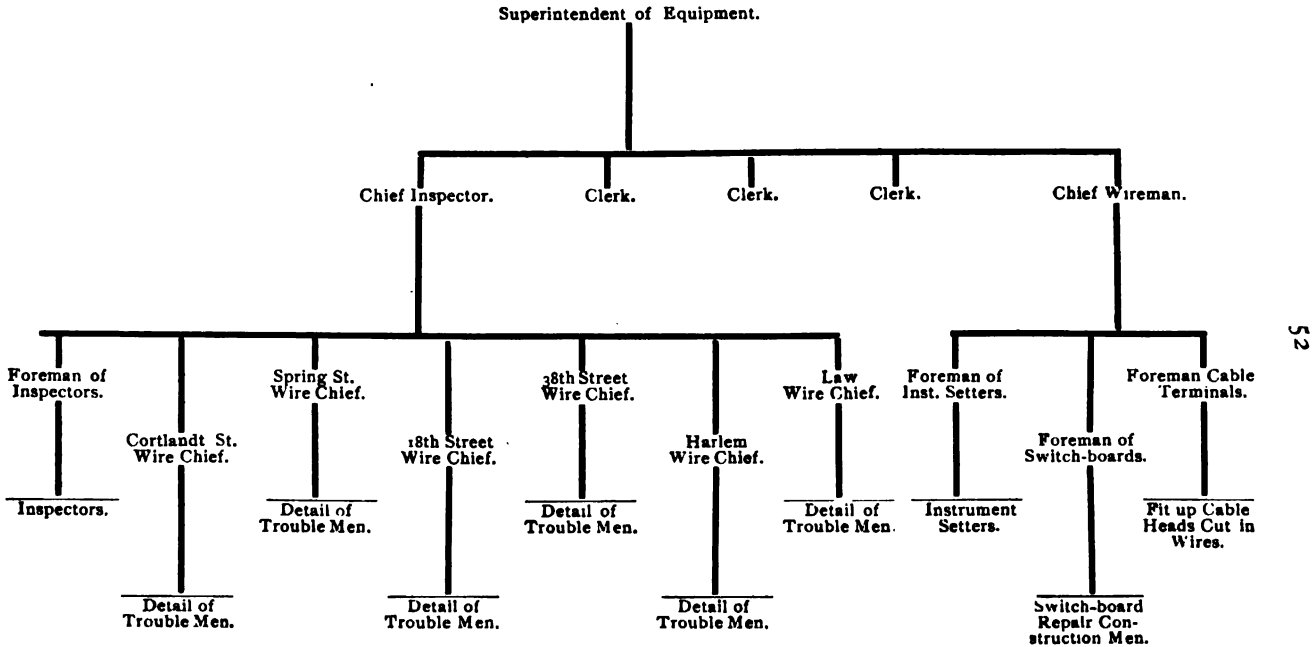


DIAGRAM ILLUSTRATING MR. CARTY'S REMARKS.

An arrangement of this kind enables you to keep up records of trouble, and compare one office with another, and make some important savings in the number of men at each office.

MR. BARTON—I should understand from this diagram and from what Mr. Carty says, that the chief operator, we will say, of the Spring street exchange, would have charge of the operating force—that is, of the operator who answers the subscriber who calls up a connection—but that the chief operator and the operators themselves are not in this organization at all?

MR. CARTY—No, they are quite separate.

MR. BARTON—They are another department?

MR. CARTY—Yes, sir.

MR. BARTON—Then at the Spring street exchange there is a chief operator and a wire-chief; one who has authority over the operators, and the other has authority and control over the apparatus, and they give information from one to the other, but there is no authority passing from one to the other?

MR. CARTY—No. There is simply a line of communication between the two. The manager of the office, or the chief operator, is responsible for the service of that office, and if there is any fault with the Equipment Department it is his duty to get it on record; but the responsibility of the plant rests with the Superintendent of Equipment, and is accordingly a separate matter from that of operating a switch-board.

MR. HALL—I think perhaps I could go a little further by reference to the original diagram. Mr. Carty has taken the diagram at this point [indicating], and has shown what is done by the special division of the force under his charge. Now, the central thought of all that is this: that in that company one man is responsible for the condition of every line and switch-board in the exchange: there is one man responsible for the physical condition of the property; he has no relation with the operators or with the operating

service. That is an entirely separate department, but he is responsible for the operators and the subscribers being furnished with suitable apparatus, and apparatus properly taken care of. That simplifies the problem as to who is responsible for any fault in the service. If the fault is one of apparatus or maintenance, then the Superintendent of Equipment is to blame. He has nothing to do with the construction of that plant, and he has nothing to do with the operation of it. The question might then be raised that, having nothing to do with the construction of a thing, it might not be properly constructed. That is possible; but his skirts are entirely clear, because all he has to do is to report to the General Superintendent that as a certain thing is constructed it is not possible for him to keep it in proper order. Then he is relieved from blame. The General Superintendent may refer the matter to the General Manager. It may or may not be possible to correct it. If it cannot be corrected, then the Superintendent of Equipment simply does the best he can with what is furnished him. If it can be remedied, then it becomes a question for superior authority to give the necessary instructions. In each of these offices "detailed operators" and "detailed inspectors" are under the Office Manager. That means that while these men are under the Office Manager, he does not employ them. They are simply placed there for the purpose of receiving information as to what is to be done in their work. To illustrate: If a subscriber in the Harlem office is in trouble, the proper place for that information to go is to the Superintendent of Equipment, because he is responsible for it. His office is at Cortlandt street. Now, it would not be reasonable for him to send a man away up to Harlem to fix that. So as a matter of convenience this Superintendent details a certain number of men to receive their instructions from the manager of the office at Harlem, and the manager of the office at Harlem simply informs those men that line so and so is in trouble. His duties are ended when he has given them that information. The men go out, and if the

man who is sent to fix it cannot do so he reports back, not to the Office Manager, but to his superior, the Superintendent of Equipment, as to what is to be done, and gets information how it is to be fixed. In the office of the Superintendent of Equipment there is a complete record kept, and it comes down to this; that I should expect Mr. Carty to be able to say at a moment's notice exactly what the history had been of any instrument in his company for any period of time under which he had had the system in operation; his records would show precisely all that had been done by every man in every department under his charge. If he has 10,000 or 15,000 stations to look after, he must have a complete system of doing it, because he cannot have personal knowledge and must depend upon his records.

MR. GIFFORD—Your Superintendent of Equipment does not undertake to build anything. He simply undertakes to take care of it?

MR HALL—Yes, sir; and that brings up another thing: written specifications should be made out, defining precisely what the Superintendent of Equipment and every other employé is to do. I saw a quotation from Bacon the other day, which struck me as very appropriate. He says: "Reading maketh a full man; conference, a ready man; and writing, an exact man." When you undertake to write the exact functions which an employé is to perform, you must be perfectly clear in your own mind what they are. I consider it essentially a part of a diagram scheme that you should write out in detail just what each employé is to do.

Then there is another point. The forms and blanks in use are sometimes defective. In one company recently we had an expert go through the whole organization and system, from the subscriber's order up to the rendering of the Treasurer's bill. He determined first, whether the books of the Company were in such shape as should be required; whether each man knew exactly what he had to do; and whether he was supplied with records to keep account of things. And right here let me say that a proper organization does not mean red tape and complications—it means

simplification. I have found that in most companies there are a lot of duplications, unnecessary routine. The fault does not lie usually in having too little, but in having too much. In arranging the organization to which I referred, instead of undertaking to take the blanks and forms of the Company and determine which should be dropped and which continued, we simply closed the books and started out to plan for what we thought ought to exist; that is, we arranged the forces until what had existed was brought into line, and we made the books fit the business. The only way to do is to start and organize as if you were beginning a new concern; and then, if what you have already corresponds to that, why, all right: if something is unnecessary, omit it.

Under this system properly applied, it would be impossible for any serious fault to exist in a company. To the extent that you fall short of proper organization, you pave the way for trouble.

MR. EASTABROOK—As the long distance company is beginning to touch the different companies, and the further they go the more the complication arises, the matter of toll-rates and the pro-rating of toll-rates is becoming a very important subject. Where would you locate that, on what level, and how would you reach it—through the general manager's department, or through the auditor?

MR. HALL—The American Bell license would fix that.

MR. EASTABROOK—But in the organization of any company, who should act for it with regard to that?

MR. HALL—Any of the relations which exist between companies are ordinarily established either by the presidents or by the general managers.

MR. EASTABROOK—I understand that, but you have not subdivided that there. I only wanted to get your idea about it.

MR. TYLER—Mr. Eastabrook's question would be answered by saying that the matter should be settled just as each individual company would be willing to do it for their company.

MR. HALL—My idea would be that rate questions should go to the general manager.

THE PRESIDENT—Are there any further remarks on this paper?

MR. HALL—There has been a suggestion made that the faults of an organization come generally from those high in authority in it rather than from the subordinates. That is very often so. For instance, the president may have personal knowledge of something wrong and he comes straight across and tells the superintendent of construction that he must do this or that. Now, that is fatal to a proper organization. It is something the president should never do except in an extreme case. Of course, he has a right to do it, but when he does it he relieves the general manager and the general superintendent of all responsibility, and for this reason as well as for the reason that it demoralizes subordinates it is a right that should be exercised very rarely. He ought to give his orders to the proper official and let them be transmitted through the regular channel.

MR. LOCKWOOD—I feel like saying that so far as we have gone this meeting seems to be one of the most instructive and profitable that we have had for some years. This matter of proper authority and the proper delegation of authority is one of great confidence. Prior to my present employment I was for six or seven years with different electrical companies, and I think I may say that there was but one of them which was properly organized. Where there is defective organization there will always be conflict of authority. The company I refer to was the American District Telegraph Company of New York. It started out under the superintendence of Mr. Hotchkiss, and then Mr. William H. Sawyer was the second general superintendent, and he was followed by Mr. Durant, now of St. Louis, and H. W. Pope; but it was under Mr. Pope that the organization was perfected. Conflict of authority is fatal to good work. Where every man's position is strictly defined he knows he cannot tread upon anybody's toes. Following

out the line that Mr. Hall referred to last, it has often come to my knowledge that a president or a general manager, ignoring all intermediate channels, will meet some office manager or some lineman, perhaps, and will say that such a line is out of order, why don't you fix it, or will give absolute orders, and the office manager or the lineman is bound of course to carry out these instructions; but frequently, if he does so, and if he doesn't carry the information on the back-track to his intermediate superior, there will be at once hard feelings generated on the part of those men who quite unwarrantably will assume that this man had no business to carry out orders except they were given through the proper channel. It would also be a pleasant thing for this subordinate to say to the president, "I will do so and so, and I will also speak to my general superintendent about it." By so doing he will convey a delicate lesson and not cause any hard feeling, and, ten to one, the president who gives him the order will say, "Certainly, I wish you to do it, but I wish you to do it in the right way."

On motion of Mr. Tyler the convention adjourned until Wednesday at 10 A. M.

SECOND DAY'S PROCEEDINGS.

WEDNESDAY, September 10, 1890.

MORNING SESSION.

THE PRESIDENT—The first business this morning is the selection of a place for our next meeting. Nominations are now in order.

MR. CRANDELL—I believe it was generally understood at our last meeting in Minneapolis that New Orleans would be selected for the meeting in 1891. I hope there has been no change in the opinion of members since then, as I can

assure you that we all heartily desire to have this Association meet there next year. I have received assurance from the older members of their desire to go there; many of them have inquired whether the girls were as pretty in New Orleans as I stated at our last annual meeting they were; and upon reassuring them of the truth of that statement, they have determined to stand by me anyhow, and I hope the younger men will, too [laughter]; and if you will come down there, I am satisfied that you won't be disappointed. I would suggest, however, that the date of meeting should be left to the Executive Committee. I therefore place in nomination the City of New Orleans as the next place of meeting, and hope it will not have any opposition—not that I expect that it will be defeated, but simply because I don't want to antagonize any of my friends.

MR. E. J. HALL, SR.—You will recollect that last year Buffalo put in a bid for this convention, which was afterward withdrawn in favor of Detroit. I rise to state that that invitation is still open. I don't know how much caucusing Mr. Crandell has done for New Orleans. I haven't done any for Buffalo. [Laughter.]

MR. CRANDELL—I would remark that I know that this is all spontaneous on the part of my friend Mr. Hall, from the great bump of hospitality there is in him. He is one of the men who has been talking to me about pretty girls and saying he wanted to go to New Orleans. [Laughter.]

THE PRESIDENT—The Chair would announce that he has received a letter from the proprietor of the Hotel Stockton at Cape May, suggesting that this Association meet there in either 1891 or 1892.

MR. EASTABROOK—In order to get the sense of the house, I move that the invitation from New Orleans as a place for our next annual meeting, be accepted; and that the time for the meeting be left with the Executive Committee to determine. I may state that my personal reason for wishing to go there is that I like "red snapper" better than "lake whitefish." [Laughter.]

The motion was duly seconded, and carried unanimously.

THE PRESIDENT—The next business is the reading of papers. Mr. W. F. Patterson, of Chicago, will read a paper on "The Housing and Care of Central Office Apparatus."

Mr. Patterson then read his paper, as follows:

THE HOUSING AND CARE OF CENTRAL OFFICE APPARATUS.

BY W. R. PATTERSON.

It is not the object of this paper to furnish plans in detail or to establish a fixed pattern for exchange buildings, but rather to offer some general suggestions, some of which may be carried out to advantage, and some of which I believe must be in order to insure for the apparatus long life, economical maintenance and satisfactory service.

The cost of the apparatus in a large central office is often greater than the cost of the building which contains it; at the least, it is equal to a very considerable fraction of the cost of the building.

In renting an operating room for a short time, there may be some excuse for taking things as they are found and working the exchange at a disadvantage in some particulars; but when a special building is to be erected, nominally as a telephone exchange building, it must be something more than an office building with the most undesirable part grudgingly spared for an operating room. An outside income from rental of offices and stores is a good thing, unless it is secured at the expense of the legitimate business of the Company. The switch apparatus of an exchange system is not a lot of separate instruments, like the outfit of a telegraph office, but it is a complex entity which requires weeks or months to put in position, and the parts of which are not easily removable or accessible. Therefore, in planning the construction of a building the fact must not be lost sight of that it is a Telephone Building, and that its purpose is to protect the central office apparatus and facilitate economical and satisfactory service.

In planning a new building the Company's electrician is to be consulted before the architect. The electrician's duty is to plan a switch-board room with reference to the best possible arrangement of the board and all the apparatus connected therewith, having as the only limitation the size and shape of the building lot. The process of evolution of the building must be: First, the switch-board with its accessories; second, the finished rooms to contain them; third, the building of which these rooms form a part. At the third stage, and not till then, except as a consulting engineer, should the architect be called in. Give him the building lot and the finished operating room and its complete equipment as his limitations, and then let him do the best he can with the building.

As to the location of the operating room in the building, precedent is for the top floor. When all the wires were on poles and housetops the most convenient place for the switch-board was at the top of the building. The use of underground wires is almost universal, at least for leading in from neighboring

poles, and this would suggest that a more advantageous place might be found in the lower part of the building. It is impracticable to lay down any hard and fast law, but it would seem that the use of the first or second floor for an operating room was worth considering. Financially, the problem is whether the rental value of the top story, plus the rental value of the space occupied in each story by the cables leading in, plus the interest and depreciation on such cables, is greater or less than the rental value of the first or second floor. In case of a building covering an entire lot the advantages of an operating room on a lower floor are not so obvious, but in a large building where an interior or rear court is left for light, the operating room may economically be placed on the second floor, building up the court two stories instead of one and using the rear of the basement and first floors for storage—so that, for example, the room taken for the exchange room would be the rear of the second story, as against the whole of the top story. Of course this is only an illustration of what might be done in one case.

Electrically, everything is in favor of an operating room near the ground when, as is generally the practice, underground cables are used. One or two hundred feet of cable made a permanent part of every circuit is in itself of no importance; but in large cities the amount of cable absolutely required elsewhere and the possibilities of long distance work with connections into and through other cities, make it important to cut the amount of cable down to what must be used.

All these things and many others which local conditions impose being considered, and the operating room planned and its position in the building determined, the next points for consideration are: Getting the switch-board and other apparatus into the room; connecting the switch-board with the underground conduits; heating, lighting and ventilating the operating room, and protecting it and its contents from fire.

Providing means for getting in and out with apparatus must be considered. In making plans, the best way is to project into space the switch-board, then project around it an operating room, and then fill in the rest with the best arrangement of rooms and offices. But in building, the process must be reversed—first, the building, then finish the operating room, and last of all, put in its furniture.

Dragging switch-board sections into an unfinished building through a window or hole left in the wall is poor policy. While the ultimate end of any machine is the junk shop, a piece of work like a switch-board makes more progress towards that end in a few weeks in an unfinished building than in years of service.

Provision must be made for getting cables from the street conduit to the switch-board. The position of the building relative to the conduit, and the number of cables to be accommodated, will determine the best way of getting from the conduit into the building. In general, a tunnel accessible throughout its whole length is best. If the cables are to be taken up through the building to an operating room on the top floor, there are several ways of getting them there. One is through ducts built in the wall; another through pipes fastened

to the walls, either inside or outside; another is through a shaft or well-hole in which the cables are accessible. Whichever plan is adopted, it should be carried out in such a way that cables of as good specifications as the regular underground cables can be used. In general, the shaft is the best plan, then the pipes on the walls, and least satisfactory, the system of small flues in the walls. The shaft is of advantage, not only in handling cables, but also as a ventilator for the conduit. A good plan for a large exchange, to require a hundred or more cables, is a straight tunnel or passageway through the building from the conduit in the street to a point under the cable terminal room. From the inner end of this tunnel a straight shaft to be carried through the roof with provision made for clamping the cables upon the sides at short distances, and with a stairway or an elevator in the center; the cables to run continuously from the street to a terminal room adjacent to and practically a part of the switch-board room. If the operating room is on the lower floor, the large shaft through the roof will be unnecessary—provision being made for a shaft or flue large enough to ventilate the conduit, either by natural draft or by a fan.

Now, as to the construction of the operating room itself, with reference to lighting, heating, ventilating and fireproofing: First, let us consider the contents of the room. The apparatus therein forms a part of every circuit; and every conversation passes through it. The time is rapidly approaching when all the circuits will be metallic—that is, a circuit will be no longer a single wire, but two sides which must be balanced within a very small limit—balanced not only in resistance, but in capacity and insulation. Then there are in spring-jacks and keys, contact points, numbering in the aggregate into the hundreds of thousands, poor contact in any one of which will cause poor service on some line. The surfaces on which the springs and contacts are mounted, and to a greater or less extent the insulating material of the thousands of miles of wire used in connections, are hygroscopic, and the insulation of this part of the circuit rapidly falls with the increase of moisture in suspension in the air. A particle of dust under a contact spring either opens the line entirely or throws in more resistance than the whole circuit should have. The extension of underground telephone circuits, the increase of electric light and motor lines, and the continued demand for better service—all require that better work shall be done in the switch board room than was even suggested a few years ago. This being the case, more thought must be given in the future to the heating, ventilating and care of such a room than they have received in the past. Instead of letting this matter rest and provision be made for heating as a sort of afterthought after the building is planned, and no provision made for ventilating except by open windows and doors, it must be one of the first to receive attention. The heating and ventilating of the operating room must be planned together. Windows and doors as a means of ventilation must be ignored and windows only used for light. Heating should be by a system of indirect radiation, and the air must be at all seasons of the year of uniform dryness and freed from dust. The coils for heating the air in the winter may be used for cooling it in the summer, circulating cold water or a freezing mixture through them instead of steam. The electrical and mechanical engineer must furnish the detailed plans and specifications for this work, and the architect must accept

them, together with the switch-board room and cable conduit, as the things around which the building is to be erected.

When windows are used for ventilation good service cannot be expected. In a city where soft coal is burned the soot is a cause of high resistance if deposited on the contacts; and making contacts of platinum will not remove it, because the separation of the surfaces is a mechanical one and is not due to surface corrosion. This soot is much worse than street dust, since it is adhesive, and the continued closing of contact springs stamps it down on the surface so that only a file or scraper will remove it; on account of its adhesiveness putting contacts vertically will not cure all the trouble, for the reason that the particles of soot will not fall off. Smoke from hard coal is less objectionable, but even this causes corrosion of contact surfaces and renders the use of platinum necessary. Apart from these electrical difficulties caused by dust, its presence—more especially gritty street dust—in the room causes the rapid wear of cams, plungers and other parts of the apparatus which require to have a motion which can be affected by friction. A switch-board set so that a draft of smoky or dusty air passes through will arrest a great part of the ponderable particles. The principle of dust arresters used in pipes from sawmills, grinding rooms and the like is that the current of dust-laden air has its direction suddenly changed. The inertia of the particles preventing them from changing their direction promptly, they are left; while the air pursues a tortuous course and escapes. The springs and wires act in just this way on a current of air driven through the board. Inclosing the back of the board is good so far as it goes, but it is not enough. It is much easier to keep dirt out of the room than to keep it out of the board when freely admitted into the room.

In cities exposed to frequent fogs, especially along the coast, the insulation of the apparatus will run very low at times, and the deposition of salt on the surfaces makes them more hygroscopic and tends to increase the escape. The only insulating material suitable for most of the switch-board work is vulcanite or hard rubber. This is a vulcanized compound, and a continual moistening and drying of its surface results in the oxidation of sulphur to form sulphuric acid. Both these causes result in a permanent lowering of the insulation.

The regulation of the amount of moisture in the air, and its removal above a hurtful limit, has also a direct bearing on the fireproofing of the board. Of necessity, a great mass of insulated wires must be used to connect key-tables and jacks. The spring-jack connections can to a great extent be cabled, and by this means made less inflammable, but the keyboards must be wired with loose wires. There is no insulating material available so far that is both moisture proof and fireproof. Fireproof qualities are generally made secondary to waterproof qualities, and so the under and back sides of the boards are covered with an inflammable mass of paraffine, beeswax or rubber-covered wire. If hurtful amounts of moisture can be kept out of the room, the problem of fireproofing is solved, because dry cotton or silk can be used for the insulation of the wires. A wire closely covered with dry cotton is as near fireproof as it can be made, and the only objection to be brought against its use is its hygroscopic nature and the consequent low insulation resulting from moisture absorbed from the air.

Precautions having thus been taken to prevent the ingress of dust and moisture with the air, the room should also be constructed with reference to its care, and with a view to reducing to a minimum the production of dust and dirt within the room. A tile floor, or at the least one of well finished hard wood, will assist in this, and the janitor must have learned his trade in a picture gallery rather than on a canal-boat. Battery and repair rooms must be entirely disconnected from the switch-board and cable rooms, and the operators coming in from muddy streets should not go into the switch-board room to reach their dressing room. Dust-collecting and producing carpets, rugs and hangings must be omitted from the furniture, and it may be that some time the operators will be required to dress in the least dust and lint-producing fabrics. Before that time, however, the manufacturers will be expected to produce a cord that will not fray out and add its contribution to the dust.

It may seem that too much importance has been attached to such little things as a regulation of moisture to within a small percentage, and removing dust. But all the precautions advised are no more insignificant than have to be observed in some branches of manufacture, notably the spinning of fine cotton. The telephone itself is made up of little things. The little things in connection with circuit construction, cable work, strong current protectors and line tests, have been worked out to a greater or less extent, and no step has been so small as not to show an improvement in the result. The next advance is to be in the proper care of the switching apparatus and in the construction of exchange buildings mainly with a view to the protection of the apparatus.

Now, having decided upon the position of the room in the building; your electrical engineer having laid out the floor plan of board and cable room; your heating engineer having provided ducts and rooms for admitting and treating air, you are ready for the architect. You will have projected into space the rooms devoted to exchange work, and the connection of these rooms with the street conduits, and the complete heating and ventilating plant attached. This is turned over to the architect. He may not be able with these limitations to introduce all the artistic features he would desire in the front; he may not be able to plan such desirable suites of offices as he would if left to his own devices; he may not be able to plan stores more desirable to tenants than anything else in the neighborhood; but you will have an exchange room which is not an afterthought, and which is not the leavings of everything else. In such a room the life of the apparatus will be prolonged, and if originally well constructed it can be depended upon to give uniformly good service.

There may be exchanges working under exceptionably favorable conditions of climate and surroundings where all these precautions would seem unnecessary, but none of them are very expensive and none of them could do any harm.

In existing buildings, where the record of troubles shows a preponderance of open contacts and where frequent cleaning of contact points is found necessary, it would undoubtedly pay to introduce the heating and ventilating plan above recommended. An indirect radiation system of heating is fully as cheap as any other, the only additional expense being the running of the apparatus for ventilation when artificial heat is not required. This expense would

not be worth considering if all trouble from open and high resistance contacts could be avoided. That it can be there is no reason to doubt. If the dirt is kept out of the room it cannot get into the board; if moisture is kept out of the room it cannot get into the insulation of the wires. Dirt can be kept out of the room and the degree of moisture regulated just as well in a switchboard room as in a theatre, library or spinning room.

THE PRESIDENT—I understand that Mr. F. A. Pickernell has prepared a paper somewhat in the same line, and, before inviting any discussion, I will ask him to read it, so that the two papers may be considered together.

Mr. Pickernell then read his paper, as follows:

SOME GENERAL REMARKS ON TELEPHONE EXCHANGE CONSTRUCTION AND EQUIPMENT.

BY F. A. PICKERNELL.

The modern telephone exchange building should be thoroughly fire-proof. False floors and concealed masses of wires should be avoided, for a fire once started in such places is extinguished with great difficulty. In its erection everything should be sacrificed that in any way interferes with the particular object for which it is built. In the basement racks are to be provided for underground cables. Between the basement and terminal room a cable shaft or system of ducts is to be constructed. On the top floor are to be located the operating, terminal, battery and power, cloak and lunch rooms. These rooms should be provided with chemical fire extinguishers, and the manager, fire chief and his assistants thoroughly instructed in their use.

In case of fire every effort should be made to suppress it without calling on the fire department. If the fire should attain considerable proportions, it could at its worst only consume all the combustible matter in the room, for inasmuch as the operating room is on the top floor the fire would not cripple any of the supporting columns or beams of the building and cause it to fall. If a small fire was started and the average fireman admitted, he would do more damage with his axe and hose than the fire would in entirely consuming the apparatus.

Before a telephone company is in a position to erect a suitable building it is necessary to make definite estimates of the probable extent of the underground work, the ultimate number of subscribers it will be desirable to handle at the proposed exchange, the probable number of trunks to other exchanges, the probable number of extra-territorial lines, the amount of private wire business, the probable average number of calls per subscriber per day, when the switchboard attains its ultimate capacity. A careful estimate of this kind determines the ultimate capacity of the switchboards, underground cable runs, etc., and consequently fixes the minimum size of the building.

In order that the building may fulfill the requirements of a modern telephone exchange, a technical expert should be provided with these estimates, and his opinion taken before any land is purchased or building erected. He should collaborate with the architect in making the building plans. Mistakes have already been made by telephone companies in adopting plans of good office buildings and afterwards placing the switchboard wherever room could be found. Such buildings have been found unsuitable for modern telephone exchanges. It does not follow from this that the requirements of a good telephone building are necessarily incompatible with the demands of an office building.

One of the first matters to be considered in planning the building is the handling of the underground cables. The system for bringing in the cables should be thoroughly flexible, and permit of the drawing in and out of any particular cable when the point of ultimate equipment is reached. The cables are to be extended through the basement to vertical rows of ducts, or to a suitable cable shaft, extending to the cable terminal room. The massing of the cables in rows of ducts exceeding two in number should be avoided. Whenever it is necessary to pass from one system of ducts to another system, the cable should be brought into a vertical row, thus rendering each cable accessible. Before any building plan is adopted, a complete working plan for the handling of the underground cables should be made. This working plan should show the exact location of every cable in the subway at each turn and the location of its inside terminal.

It is preferable to head up cables in a terminal containing a sneak current and lightning arrester. The sneak current arrester should operate with the current of three-tenths of an ampère in 40 seconds, and the lightning arrester should operate when the potential of the wire rises to 300 volts. By using a combined cable head and strong current arrester, economy in space as well as in expense is insured. The strong current arrester should be so designed that the lines can be tested at this point by using suitable plugs. The terminal room should also contain a distributing board and chief inspector's desk. The most economical, compact and flexible distributing board that has yet been devised is that known as the "Hibbard iron distributing board." The cable terminals should be connected with the line side of the distributing board by flexible cable, all connections being soldered. The switchboard cables terminate on its other side. For cross-connecting wires, Okonite wire No. 20 B. & S. gauge, insulated to $\frac{3}{32}$ of an inch, twisted in pairs, should be used, all connections being soldered.

The chief inspector's desk should be located immediately in front of the distributing board and should be provided with a telephone outfit, Morse key and relay, Wheatstone bridge and galvanometer and loops extending to the tower and battery room, local switchboard and chief operator's desk. It should be provided with testing plugs for use at the strong current arrester.

Near the terminal room should be located a power and battery room, and in this room battery racks should be provided upon which the operator's transmitter batteries and the chief inspector's testing batteries can be located

The battery rack should be wired with waterproof wire in a permanent manner. In this room a generator switchboard should be provided, and have terminating upon it loops to the various portions of the multiple board and also the terminals of all generators. Electric motors, water motors, or other suitable power supply, should be located here. Both the terminal room and battery and power room should be so located that it will be possible to enter them without passing through the operating room.

On the same floor and adjacent to the terminal room should be located the operating room. This room should be large and well ventilated, free from elevator shafts, columns or other obstructions. The switchboard should commence at the end of the operating room nearest the terminal room and extend from it in a straight line. If it becomes necessary to deflect the switchboard from a straight line it should be arranged so that the operators sit on the inside of the curve. This enables the chief operator's desk to be so located that all parts of the switchboard are visible from this point. The size of the room necessary will depend upon the ultimate capacity of the switchboard.

If the switchboard is to have an ultimate capacity of 4,000 lines or over the extra-territorial trunk section should be the first in the system. It should be equipped with five-point spring-jacks and three-point plugs, so that when a line is in use at the trunk section it tests busy at the other boards.

If a switchboard is to have a capacity of less than 4,000 lines, the trunk board should be made the last section in the system, and the regular Chicago spring-jack used. The reason for locating it last in the system is as follows: Whenever a metallic circuit connection is made at any section, an open leg is attached, which extends throughout the rest of the board, to the answering jack, the open leg being shortest on connections made at the last section. In large boards this introduces an appreciable amount of cross talk. By making the trunk line section the last section in the board all connections made at this board have a minimum length of open leg, and consequently the switchboard cross talk is reduced to a minimum. The answering jack should be the last spring-jack in the system, thus insuring in every connection at least one of the parties connected having no open leg attached to his circuit. If the answering jack were the first spring-jack in the section, every connection would have at least one open leg attached to it extending throughout the whole system.

Next to the trunk section comes the regular multiple board, the number of sections depending upon its present equipment. It has been found that the sections of multiple board six panels wide, of the hog-trough type and having an ultimate capacity of 300 subscribers' drops, is the most desirable form of multiple switchboard. On the back of the hog-trough is to be located a cord shelf upon which both cords are to be placed. In the face of the board, immediately above the cord itself, is to be placed the answering jacks; above the answering jacks the subscribers' jacks.

The standard condenser listening and long-distance ringing keys with talking contacts of platinum have been found to give most excellent service. On the frame work immediately under the back of the cord shelf is to be located an intermediate distributing board. It has been found that it is possible to so distribute the busy subscribers with those that are not so busy, as to make

approximately equal the work for all the operators. In order to do this, without changing the number of the subscriber, the intermediate distributing board has been designed. One side of this board is connected with the answering jack and subscribers' drop, and the other side to the cables coming from the multiple board. By placing two numbers on the subscribers' drop, one on the shutter corresponding with the answering jack and one on the face plate corresponding with the spring-jack number of the multiple board, it is possible to make cross connections at the intermediate distributing board and not change the drop number of the subscriber.

A change of this kind will be effected as follows: Suppose that the operator upon which subscriber No. 654 terminates was very busy, and that the operator upon which subscriber No. 235 terminates was not so busy; and also that the subscriber No. 654 was a very busy wire, and subscriber No. 235 was not a busy wire, it would be desirable to interchange the answering jacks of these two subscribers, for by so doing the work of the operators would be more equally divided. This would be done at the intermediate distributing board by cross connecting the two answering jacks and by changing the face plates on these two subscribers' drops. The office record of circuits should be so constituted as to admit of this dual numbering of drops.

The double track system for intercommunication between offices is recommended. Push buttons connecting local operators with the talking circuits are to be placed within easy reach in front of each operator. All incoming trunks should terminate on single cords, and be operated by a call wire system. For this purpose the incoming trunk line operator has his head telephone included in the talking circuit from the other exchanges. The trunk circuits should be arranged so that if the calling wire breaks down, any other trunk line may be quickly substituted, and pending the change, the trunk lines operated by drops. It is also desirable to have the circuits so constructed that when the operator at the originating office disconnects a trunk line, the operator at the receiving office is notified automatically by special signal. This reduces the number of calls on the talking circuit one-half.

In front of the switchboard, in such a position that all sections may be easily seen, a monitor desk should be placed. This desk should have, terminating on spring jacks, loops extending to each operator, to the chief inspector's desk and to circuits in the multiple board. All operating rooms should be carpeted with linoleum to prevent noise by people walking about. On the same floor as the operating room a cloak room and lunch room should be provided. The lunch room should be equipped with tea and coffee urns, lunch table, etc. By providing such conveniences for the operators a better class of women become available and exchange service correspondingly improved.

In closing these remarks, I would call attention to the necessity of providing complete working plans and specifications of the proposed equipment, including the cable run, before the construction of the building is commenced. Extensive alterations in buildings and apparatus already made in several of our central offices would not have been necessary had this been done. Such plans are as necessary to the successful and economical erection of a modern telephone exchange as are the plans for the erection of a suspension bridge or other engineering work.

MR. WILSON—We have had read now two papers, one of which advocates an operating room on the top floor, and the other an operating room on the second floor. I hope that point will be freely discussed, because I happen to be in a position where we are about to erect several new buildings and I would like to have the advantages of the locations fully brought out. It seems to me that the only advantage in having an operating room on the second floor would be in the length of the cables, and, as Mr. Patterson has expressed it, the expense of the cables as compared with the value of the second floor would be the only consideration. But I think the advantages in favor of ventilation and light and rendering the operating room more exclusive from outsiders is in favor of the top floor.

MR. HIBBARD—I think that question is one of the primary points and just as important in its relation to a telephone exchange as the question of the value of the building. If the operating room is on the top floor you will more than make up for the increased length of cable by having your operating room in a much better place. I think the advantages of having the operating room in the top of a building are very great. It has been the practice generally followed. The ventilation and the light obtained are strong points in favor of the selection of the top floor. It is better to have the operators up there where they are out of the way and more free from interruption. We have exchanges in New York, where the operating room has been given a black eye by running an elevator into it. Now, the operating room is for the operators, and in a large exchange where you employ from fifty to one hundred young women, I think it is a good plan to have them up in the top of the building, out of the thoroughfare. Besides, the operating room should be convenient to where the cable is hung up and where the distributing board is. That is quite a point to be desired in a big local exchange. These constitute three links in the successful working of an exchange: The head of a cable is one; the distributing board is another;

and its entrance to the multiple board is the third. Now, if it is possible to hold those three points within the reach of the man who has it all in charge, it is like driving a four-in-hand team—he has a good grasp on the business. If, however, you put in a terminal point in the basement and a distributing board away up in a tower, perhaps, and an exchange board in a third place, these links become disjointed, and as a result your team is apt to go badly.

MR. PICKERNELL—I think one other objection to having the operating room on the second floor is the noise because of the close proximity to the street. In Cortlandt street, if the operating room was on the second floor it would be almost impossible to operate it. We have to have three sound-proof booths in the front offices there in order to be able to use the telephone at all.

MR. CRANDELL—And is not the dust arising from the street another objection to placing the operating room on the second floor?

MR. PICKERNELL—Yes, I think it is.

MR. PATTERSON—I did not intend to advocate the first or second floor locations as against the top floor in all cases. So far as dust and noise is concerned, the lower floors would not be so objectionable if the operating room was placed in the rear, facing on a court, for instance, and lighted by a skylight from above, and the heating and ventilation taken care of by artificial means.

MR. HIBBARD—I think that the putting in of dry air into your operating room is of essential importance. We should put in nothing wet, and should keep out all dirt and dust. Now, I have noticed in offices located on the top floors where it is possible to keep the windows open, that they have not only a much pleasanter office to work in, but the operating service is superior. The operators like the fresh air, and the better you treat them in their surroundings the better the operating that takes place. I recollect an exchange in which, a few years ago, they had flowers at one end of the room, and if you went in there on a hot day the

work went on without any appreciable difficulty, and the operators seemed to be a contented lot. I think since that time the flowers have ceased to bloom, and more switchboards have been put in, and it is not the same office, either in appearance or efficiency, that it formerly was.

MR. GIFFORD—I think the locality has something to do with the building of an exchange. In Louisville our exchange or operating room is on the second floor, but we are situated in the middle of a square, and in a comparatively clean, pleasant location. We combine both recommendations -- the second floor and the benefits of the top floor also. We have a big skylight in the top of our operating room, and then we have windows besides. We have a hard-wood floor, and we get very little dust. Our switchboards are all cased in. We don't succeed in keeping all the dust out, however, because we use soft coal there. Now, about bringing in the cables. I formerly had our shifting room up in a little tower on the third floor, but in the last few months I have taken a room about 15x20 on the first floor, and there we have our underground system coming down on one side with branches to the east and west, and then on the north side arranged in the same way. We do not lose 25 feet in distance from where our cable terminals come in to where they are switched, and we do away with a great deal of interference and resistance. That room is just like a vault; the windows are bricked up, and I have an electric light in there, and nobody gets into that room except one man and my electrician, and I hold them responsible for everything in there.

MR. CARTY—I think Mr. Pickernell's paper was framed upon the idea that there was more than one employé that could be trusted to go into that room and to do the work there. I think we should so organize our staff that any number could go in there. I think it would be a good thing to have the Chief Inspector located in that room because then he is near the point where he could do his testing.

MR. HIBBARD—I should hardly favor the idea of having a room locked up in which you have your protectors. It is one of the features in a plan of having a testing room that the terminal and distributing room is also a point where you head up your heavy lines of underground cables. As a matter of fact, all the testing of wires is done at this head of the cable. It is a point, therefore, of frequent access. That is, you test out all the apparatus, and you test in through the switch-board all the underground cables. One of the advantages of having it accessible and next to the operating room is this: the most frequent troubles with the electric light wires are to be expected at night. There has been no arrester put in any exchange which will head off all of these kinds of troubles. Each arrester probably does its work as it has been designed in a particular line, but I do not think we have found any that are good all around. I have had, perhaps, the misfortune to have my name attached to an arrester, a great many of which are in use, but I hardly think we are in a condition yet to wrestle with the question of arresters. As the best protection now available to a telephone exchange, we should have there at all hours a means of opening our wires and saving our apparatns. If an electric light current comes in, any chief operator who is posted is able at once to go to the seat of the trouble and remedy it.

MR. GIFFORD—While I said I was going to put in one man and hold him responsible, I should have said that I have several very good men working in there to-day, but when I get the thing perfected and finished I shall keep it under the care of only one man and shall make him responsible for the care of that room.

MR. PATTERSON—I understood Mr. Hibbard to say that the operating room was not so pleasant if the windows were kept closed. Now, take this room, where we are assembled, with four windows on one side and two doors on the other. If the windows are kept open, as those sitting in the rear would no doubt desire, the noise from the street would prevent those in front from hearing what took place in the

room. I think this room would be a great deal more pleasant if, instead of those windows, there were a dozen inlets for fresh air all around the room, and with the temperature graduated to suit the season of the year.

MR. CARTY—There might perhaps arise a condition where we could be helped out about lighting very much by having the operating room on the top floor and availing ourselves of skylights. If the operating room was on the second floor you might meet with some conditions that would interfere with the lighting from the windows, and you could not avail yourselves of that expedient

THE PRESIDENT—If there are no further remarks upon these papers, we will proceed to the reading of the next paper, which is by Mr. Carty, on the subject of "Bridging Bells."

THE SECRETARY—I believe Mr. Carty has some arrangements to make about his diagram which will occupy him a moment or two, and, while he is doing that, I would like to present the resignation of Mr. C. E. Bailey as an honorary member, which I received yesterday. It is written from Atlanta, Georgia, is addressed to this Association, and reads as follows :

"Gentlemen—I respectfully tender to you my resignation as an honorary member of your Association. Success to you. (Signed) C. E. Bailey." I will say in explanation that Mr. Bailey was elected an honorary member several years ago when he was in Havana, Cuba. He is now in the United States, in the employ of a corporation which is an active member of this Association, and therefore feels that he should resign his honorary membership.

On motion of Mr. Crandell, duly seconded, the resignation was accepted.

THE SECRETARY—I would announce at this time that it is desired that members should be prompt in getting their dinners, so that the carriage ride may start promptly at two o'clock to-day, and also the excursion to-morrow at the same hour; and Mr. Jackson requests me to say that if anybody

has been accidentally overlooked in the matter of invitations, and will make it known to him or me, they will be supplied.

THE PRESIDENT—Now we will hear from Mr. Carty.

MR. CARTY—I was asked by the President to prepare a paper to read before the Association, but owing to the pressure of many matters of business I was unable to do so. I will, however, give you orally and briefly my views on the subject of "Bridging Bells." This is a diagram of a system of looping, the idea being, if you had more than one station on the line, to loop the intermediate stations in solid. This is the plan now in general use:

(Mr. Carty here illustrates by means of a diagram.)

It was found that a magnet in a line had something in it besides the mere resistance of the copper. The fact that wire is coiled around on an iron core offers a resistance to a telephone current a great deal more than that represented by the number of ohms of wire. On nearly all of the lines that are constructed with more than one station, all looped in, the talking over them is very poor. A line was built in New York containing eight miles of underground cable and four miles of overhead wire and ten stations looped in "solid," and it was impossible to talk over it. The bridging bells were put on that line, and the talking over it now is as near perfect as it could be. It is impossible to tell the difference between a line having ten stations on it and a line with only two stations. Mr. Sabin, of San Francisco, procured eight of these bells and put them on a line running from San José to San Francisco. The line had eight stations looped in, and it had been impossible to use it for through business at all, and talking between the way stations was very poor. But having equipped the line with these bells, he reports that it is impossible to tell the difference between talking on the way line and talking on the through line, and says that the induction on the way line bridged in this way is less than it is on the through line. So that actually it has turned out that the line works better with eight stations on

it than it did with only two. This line is of iron, and is a grounded circuit, and these bells are simply bridged in or legged on.

Now, if they give such good results on that line, I do not see why they won't fit in on all of the lines of an ordinary exchange, if proper care is taken to look after the resistance of the drops of a central office.

When lines are constructed on the bridge or multiple arc system the construction of the wire is made much simpler. For instance, a line running to eight stations might be constructed something like this (illustrating on diagram):

You simply tap on a branch and run off from it like that (indicating). There you see you make an important saving in wire. With the loop plan you would have a station in here (indicating), and use twice as much wire as you would in the bridging plan. A metallic circuit constructed in that way would look something like this (illustrating). You tap off from each side of the circuit, you see. Now, supposing you had another station over here (indicating). Tap off from this other branch in that manner (illustrating), and you could carry that still further and go off here (indicating).

To those who have to build lines that simplifies matters very much, to connect a way station on the loop plan it would go like this (illustrating); using twice as much wire, again.

Now, supposing you have a line connecting the central office with three stations on it. Ordinarily those stations are selected with regard to their location, but on the bridging plan you could have a terminal of a cable here (indicating) and run a log off here (indicating) to a subscriber, and run another one right from that same conductor up here (indicating), and another subscriber over here (indicating) could be taken off in that way.

The bell is on exhibition in the rear of this hall. It makes a magneto bell that is much simpler than any yet designed. There is no bottom contact on it, and the bell rings equally well whether the telephone is on the hook or off.

In looking at some railroad troubles in Albany I found that the drops were down and the business was paralyzed. Mr. Pickernell made a suggestion that I take up some double wound resistance coils and put them in between the drop and the ground. I did so, and it was a perfect remedy. We ordered fifty of them and fixed it. While there it occurred to me that a bridging bell would act even better. I sent one up, and it freed that line from the drop trouble. The particular bell that has been designed for this work has had introduced into it some mechanical improvements that are also applicable to the series bell. We have nut lock binding posts, and where a line was formerly fastened by a screw it is now soldered. The lightning arrester was also taken off, because you might as well paint one on there as to use the present one. The present lightning arrester forms a point generally where a fire starts. That bell was prepared with that in view, and if lightning protection is wanted it should be provided on the most improved plan and forming a part of the general scheme of protection against any currents.

I think that is briefly all there is to it. In substance, it is that if anybody here has a line with a lot of stations on it that is not working well, if he orders some of those bells they will make it work well. The Boston people have used some of the bells and have constructed a fifteen station line for the Armstrong Transfer Company, and they reported to me that, taking the old line at 1, the working of the new line might be placed at 300. The working of this system in New York has been very gratifying. We started with the New York Central Railroad, and reconstructed their ticket line and equipped it with bridging bells. Then the freight people heard about it, and now the result is that we have forty stations on three lines for that company.

A MEMBER—Are those metallic or grounded?

MR. CARTY—Those are metallic. This practice is quite different from the ordinary looping practice. For instance,

in the American Express Company—who made a large contract with us to equip them in the same way—they moved one of their stations, and we sent one of our men up and he took out the telephone, and, as had been his custom, he twisted the two ends of the wires together. That was a correct thing for him to do, as far as he knew. But it had the result, as you see here (illustrating on diagram) of just throwing the whole line out by short-circuiting it. Another man, in putting in a bridging station, drove a tack which crossed two wires together, and that prevented his bell from ringing. He started around looking for an "open," whereas he should have looked for a "short circuit." So you will see that this practice is diametrically opposed to what he had been used to.

(Replying to a question from a member:) The question of an individual bell should not be confounded with this. The first thing is to get a line over which you can talk. After that is done then that old saw might come up again of individual bells. You provide a code of signals, and all of the stations are signaled when anybody rings.

The construction of this bell is very little different from some other bells that are made to do the work, but when you come to use ten or fifteen stations on a line, you have got to have exactly that construction; and it is such an important matter to the licensees that we are making great efforts to get a patent on it. In designing that, we not only have an idea of our immediate wants, but we wanted to get a bell that we could say that could work on any line. A line is now being built which is to contain forty miles of copper wire, and to be equipped with twenty stations.

MR. LOCKWOOD—Is that a metallic circuit?

MR. CARTY—That is a metallic circuit. But that does not make any difference. If you have a grounded circuit you will have most of the troubles that are incident to grounded disturbances, although Mr. Sabin reports in his case that the disturbance is a little less. That brings up the induction question.

MR. CRANDELL—Was there any noise which created that disturbance?

MR. CARTY—What Mr. Sabin had reference to was cross-talk from adjoining wires. The magnets in this bell are simply the ordinary ones lengthened out, and 500 ohms wound on each spool. While the resistance of that measured by the Wheatstone bridge is 1,000 ohms, Mr. Hamilton makes the measurement of one of those currents about 10,000 ohms to a generator current. Now, then, with a higher rate of alternation, the resistance would run away out of sight, and it is safe to say that those bells are practically without any bad effect on transmission.

An experiment which is very interesting in that connection was made by connecting the Boston trunk wire to this New York Central R. R. ticket line. That made a line extending from the Grand Central Depot down town, and there crossing and going over to Brooklyn, and then a branch from that over to Boston; and the observer at Boston could hear the ordering of tickets at the ticket office in New York just as well, he said, as though they were in Boston. Of course when we put that line on we added six or eight miles of cable to the Boston line, and that of itself is sufficient to account for a slight diminution of the transmission which was noticed. But while we had that circuit arranged with ten stations on in New York and one station in Boston, we cut in and out sixteen of these bells which we had in the office, and nobody could tell the difference.

Now, the point at which this system breaks down first is the ringing. If you get more than twenty stations the working of the bell would be gradually weakened. If it is desirable to put on more than twenty, it is merely a question of design of the generator. In some places we have obviated that trouble by putting in a larger wire. That meant less turns and consequently a lower electro-motive force. So we had to put in stronger magnets. It is possible to make a generator that will ring any number of bells. The only limit will be the power of the subscriber to turn

the crank. In the New York Central line we put in a push button. I rather favored that. I thought that complicated signals could be sent over a line better than by a push button. Our bells are now being made with an automatic cut-in for the generator. With the other bell it is a cut-out.

A MEMBER—Do you make 18 or 20 different signals rather than one?

MR. CARTY—That is a business arrangement rather than an electrical one.

A MEMBER—There has been no system worked out for that, has there?

MR. CARTY—I think so. I haven't it in my mind now, but it is not very difficult. You could have a system of long and short rings.

MR. GIFFORD—It would be very easy to arrange that, just as the District Messenger people do with their calls coming in.

MR. BAILEY—I want to say with reference to that system that, while the ideal of telephone service is supposed to be the supplying of subscribers with an individual or single circuit—that is, a circuit on which but one telephone is placed—yet the conditions are such in a great many parts of the country, and particularly with corporations, that you cannot persuade them that that is the kind of service they want. These corporations are those that have been accustomed to telegraph systems, and they imagine that when they have a system where they can reach their different stations without the intervention of a central office, that they are getting very much better service. It doesn't matter what our opinion is about that; when you try to bring those people to your way of thinking, you will find it very much of an uphill job, and the next thing to do is to accept the conditions and accommodate them. That can be done by a system of this kind.

There is another advantage in this system which, I think, will be available in the future, and that is the way of giving cheaper telephone service on metallic circuit lines to residences. The chief difficulty that I see about the system is,

on long extended lines, the liability that you have of damage to the appparatus by lightning. Our company have had for a number of years a system similar to that in operation on quite a number of lines. We have arrived at it by running a shunt wire, commencing at the first station out from the exchange. This shunt wire is passed in through the station, and the calling wire is looped through. The operation of that is, when a call has been made the removal of the telephone opens the caller's circuit and lets the talking circuit from the earth through the shunt wire, thereby giving a free and independent wire for conversation. The talking over those lines has been magnificent. We get rid of the resistance of the coil through the circuit.

I wanted to ask Mr. Carty if he found any of the effects of those coils reached the earth as against the talking circuits. In the operation of those lines of ours we have found that in a thunder-storm the usual accidents we had was lifting the switch and turning out the induction coils or the transmitters. That we obviated by putting a bridge there which shoves the switch to the earth. So that the current more readily passes through this direct wire rather than passing through the induction coil. I do not know whether in this system the ringer coils would not be subject to destruction. I think possibly he would find considerable trouble in that respect. However, it may be met by introducing some device. I should say high resistance coils are more susceptible to damage by lightning, and when you take a line of that kind working in the country it means stations far away and hard to reach, and any damage is therefore expensive; and a long interruption to service.

MR. GIFFORD—That is a kind of business that isn't desirable to take.

MR. BAILEY—But it is a kind of business you are obliged to take.

MR. GIFFORD—I try to dodge all of that kind of business that I can.

MR. BAILEY—But I should say in Mr. Wilson's case at Chicago he will find service of that kind that he cannot

ignore. You must accept the situation and devise something that will meet the demand.

MR. GIFFORD—I do not wish to be considered as throwing any cold water on this system. I hope they will perfect their bridge bell and get a patent on it, but I do not see how it will work in all localities. Perhaps in some localities it will do. I would not know what to do with it, for instance, if I tried to use it for residence service. We make a cheap rate—all our rates are cheap [Laughter]—we make a cheap rate to get some residences. You see, in Louisville, the residences are over on one side of the town, and the business portion of the city is on the other; and we debated whether we should cultivate that trade or not. At last we made a cheap residence rate, two and three subscribers on a line. Now, the Louisville woman don't want any other woman listening on her line, and they raised so much of a row that we had to do away with it.

MR. BAILEY—Then you have had the advantage of educating those people to something better.

MR. WILSON—Reference has been made to this question in Chicago. At one time we had quite a number of very long private lines, and the stations having been added, one at a time, that condition of things was permitted to go on until we found that we had a good deal of very unsatisfactory private line service. About a year ago we established a rule that we would not take any more private lines with more than five stations upon them, and we have succeeded in getting our private line business on that basis; and, where a larger number of stations was required, we have put in what we call our private exchange service. For instance, the West-side Street Railroad Company have a private line of that description. They have their own exchange and their own operators. It costs them more money than it would to have a line run into our exchange at $125 a year each, although we give them a reduction in the rate. The expense of operators to them makes it a little more than they would have to pay us. In that way we have entirely eliminated the long line private wire difficulty.

Now, the only objection that I see to the bridging arrangement on grounded circuits is the difficulty in locating troubles on the lines. We have been bridging our clearing-out office in Chicago for about two years, and find a great improvement. We have some very long underground lines through cables, which were laid in the early history of the underground business, and with no margin for conversation at all. When we came to inserting the clearing-out drop in the old way it made conversation entirely impossible. After we re-wound our clearing-out branches with 300 to 500 ohms it brought the talk right up. So that I am well satisfied that the bridging scheme is the proper thing. But if you can avoid the bridging scheme and have independent lines, it is still better.

DR. CULBERTSON—This bridging-in question is a very important one. In Buffalo we have been doing a good deal of metallic circuit work for the last two years. We had a good many combination or party lines, which, after the electric lights were in operation, gave very poor service. We commenced this system of bridging-in with one or two or more subscribers on a line, using first the ordinary bell, which gave us of course very poor service. Then we put in 500 ohm ringing coils. With that system and with 500 ohms in the central office, we are getting first-class service with five and six stations on the line. We have also quite a number of private lines used by railway companies, where they have as many as eight and nine stations on the line, bridged in with 500-ohm bells, and those stations are giving splendid service.

MR. BAILEY—Are they all metallic circuit lines?

DR. CULBERTSON—Yes, sir; there is a great saving in wire in doing that work also. We have just legged off on a wire running from Buffalo to Rochester, nearly 90 miles, through a 500-ohm bell, about 35 miles east of Buffalo, and it has given satisfaction. I think with 1,000-ohm bells of the kind Mr. Carty has reference to we will get for that kind of work much better service. Of course, the question of testing comes in, which, I think, will be a serious one.

MR CARTY—Everything has its advantages and its disadvantages, and because one disadvantage is pointed out it does not by any means settle the whole thing. Take the case of Mr. Sabin, of San Francisco. He had a line 50 miles long. I told him what the trouble was, in the way he had it connected up. He had the advantage, then, of knowing where the trouble was, and the disadvantage of not being able to use the line. Now he can use the line, and there is no doubt but what he can find out where the trouble is.

In New York we do not recognize the long private line difficulty. Where a long private line is not desirable, why, we do not advocate the use of that bell. The ticket line that caused the development of this particular bell is the case of New York Central ticket agents scattered all over the city, who, when a traveler comes in to buy a ticket, say, for Omaha, and the condition is that he must get a berth, or a seat on the river side of the car, the ticket agent telephones up to the Wagner office and says, "Can I have a lower so and so," and the answer comes back immediately, "Car 5, lower 6." The rapidity with which they transact business over that line is startling, and I can imagine what a time they must have had selling tickets over that line when it was looped in. Now they have increased the number of their lines, and the American Express Company has come in and the Adams Express Company has been converted to that system. The Adams Company has one of these private switchboards and also a number of stations on each side of the lines. The lighterage line of the New York Central has a switch-board, but there is a certain amount of their business which they want to do by ringing up direct and not being obliged to go through a switch-board.

I do not make any contention for a patent on bridging. The bridging system is not new. It was advocated in a paper read at Minneapolis last year, and one of the first things that Mr. Hibbard did in the Long-distance Company was to throw out the looping arrangement and bridge the

operators in. Down in Cape Cod they had these three-legged lines as long ago as I can remember, and we used to laugh at them, but it turns out that they are the idea after all. It is a question of the design of the apparatus. We have succeeded in making this a practical thing.

In regard to lightning, I appreciate Mr. Bailey's position out in the country in having the bells burned out, but I would hate to complicate that bell which has been rendered so simple by putting in any of these devices. If there was any other way out of it there might be a bridging designed for that particular use. I think if he tried the most approved arrester he would not have any trouble from burning out. In fact, the trouble he speaks of is not necessarily connected with the bell at all. It is the old question of the transmitter being legged on, and the fact that it is 1,000 ohms does not make the bell any more delicate than these 500-ohm bells formerly used for bridging. I think the thickness of the insulation is the determining factor in making a discharge.

MR. WILSON—Don't you think it is true that the retardation of the coils increases the tendency to jump?

MR. CARTY—No, sir; I don't think so.

MR. HIBBARD—While we are speaking about the lightning's effect, I should think that Mr. Bailey's legging on of the talking wire was a lightning trap in itself. You get a good deal of chance for the lightning to escape to the ground. When bells burn out by lightning it is due a great deal to the mechanical way in which they have been wound. The winding of a magnet of different design has much to do with it. On a long distance line, using what is pretty generally known as a tubular drop, when it was first turned out for us, in 500-ohm drops we had a good deal of trouble. We found that the wire burned in the outer wrapper generally. That was changed so that the winding was kept away from the iron. No other change was made, and our drops are not burning out as they did before.

MR. BAILEY—It is more with reference to the trouble we have experienced with the burning out of the induction coils than the transmitter. We have not suffered with ringer coils of the metallic plates being destroyed, but in our case the ordinary arrangement is to make permanently the telephone satisfactory—the talking apparatus legged permanently on to the iron wire or to the earth, so that in the operation of the switch there is but one connection made. As against that plan of coupling a telephone with one side of the telephone in contact with the earth, would it not be better to devise switches that will cut loose both sides of the telephone?

MR. WILSON—I would dislike to see an open contact point put in a switch. It happens once in a while, but so rarely in my experience that I prefer to have the coils burn out rather than the additional contact. I think in curing one evil you would introduce another that would be worse.

MR. HIBBARD—I think it is known pretty generally where you give a high tension current any path at all it will stick to it until it entirely uses it up before it jumps any way. Mr. Bailey has been taking lightning into his loop line and then offering it a chance to get to the ground through the induction coil, and I think it is safe to say it has taken the jump on that account.

MR. CARTY—In some experiments which we made in the development of strong current protectors, it was found that we could make an air cut-out—which is another name for a lightning arrester—and that it would go out at any number of volts which you wanted to fix it at, and they got it down so low that the actual telephone current would jump itself. Now, it seems to me, that if Mr. Bailey's were equipped with a lightning arrester of that kind it would remedy the difficulty. At least, we should give that a fair trial before we undertake to complicate a bell.

MR. E. J. HALL, SR.—We have had considerable experience in both those, and the 500-ohm bells have been found

very satisfactory. I am not an electrician, but I presume these gentlemen will.work this problem out. I am speaking now from a business point. I do not see how it would be possible for us to do away with these combination lines in Buffalo. Some of our underground cables run out two miles, and if we were obliged to make single lines to parties out beyond that, we never could do it at a price which they would be willing to pay. But by attaching a pair of wires at the end of this cable and putting five or six people on, bridged in on that system, we find that we are able to furnish a subscriber a telephone at a reasonable price.

MR. FARNHAM—I do not know as I can add much to this interesting talk. We have found the bell arrangement to work admirably. We have not tried the putting of them on grounded lines. My objection has been mainly to the fear of lightning burning the bell coil. Now that we have a lightning arrester, I think we can safely do it, and we have already taken steps to put those bells on some of the lines to see how they will work. I think, as Mr. Wilson suggested, that one of the difficulties in handling them is the trouble of locating a fault or some disturbance; and I think that is where one of the advantages of electrical measurements would come in. If we have a line with four instruments on it, the resistance of the line will be 250 ohms plus that of the line, which might perhaps be 50 ohms. If the line is open beyond the second station, of course that resistance can be measured and doubled. We have got that 500 ohms, and we know by those measurements where the trouble is.

MR. CARTY—If the line was open beyond the first station, your own bell would ring just the same.

MR. FARNHAM—I am speaking of the testing of such a line from the main office. In ordinary practice when a line is open the bell does not ring, and if the line is grounded it rings better; but here, grounding a line, it does not ring the bell at all. I am speaking of exchange lines; wholly in that regard.

MR. WILSON—We have a metallic circuit from Chicago to Michigan City, about 56 miles. In addition to the two end stations we have three stations bridged across the circuit. When we first put in that equipment we had great difficulty in locating trouble. We overcome those difficulties by simply inserting a little point or switch in the bridge wire. That enabled us to call up the stations and ask them to turn the switch off five or ten minutes, and after they do that we have the old conditions of wires without any complication; and that enables us to locate this trouble, whether it is an open line or a grounded line.

MR. CARTY—I might say a word in regard to the arrangement we have for locating trouble in New York. Everything is getting more and more underground there, and the branches of spurs are necessarily made at the central office. We have arranged for a test-board on the plan of the long-distance board with private spring-jacks to the board. There will be one of those located in each of our central offices, and the wire-chief in charge of the private lines will be located in Cortlandt street. If he finds it is a short circuit he will take off all branches leading from his room, and he will then throw them onto a drop, or dispatch a trouble man on to that branch. If he finds all his own branches are all right he signals the next office up town, and they have a similar arrangement gone through with until the trouble is located. That can be done in twenty minutes on those complicated lines. We cannot only locate the trouble, but get the fault cut off and leave the other part of the circuit working.

MR. FARNHAM—What I said about measuring lines referred to exchange lines. The private lines in Boston are arranged just as Mr. Carty described.

THE PRESIDENT—Gentlemen, there are about ten minutes left before adjournment.

MR. HIBBARD—I would ask Mr. Wilson to tell us during the time that is left about the ringing in his exchange, using the Edison current. I examined it this morning at the Detroit Exchange, and I look upon it as an interesting possibility.

MR. GIFFORD—Before Mr. Wilson tells us about that, I have a motion to make. In the interesting discussion this morning we forgot one thing. We listened to two papers and to some very interesting remarks by Mr. Carty. I therefore move that the thanks of the Association be extended to those gentlemen.

The motion was duly seconded and carried.

MR. WILSON—I will say that we are operating all the transmitters in the main office of the Chicago Exchange with the Edison current, and we are accomplishing good results. We use storage batteries. We are using at present five cells of storage batteries, which has an electro-motive force of a little over two volts per cell, and gives out about five ampères of current. The five cells are connected directly with the Edison current which supplies the office with light, and are charged while we burn the light; and we do not observe any diminution in the lighting throughout the building. There is, therefore, no expense for current. The internal resistance of each cell of the storage battery is naturally very low. Consequently, as you add transmitters, it simply absorbs more current than the storage battery. The object of having five cells is that it enables us to maintain the storage battery throughout the twenty-four hours without its having become exhausted. If we connected all the transmitters we would necessarily have to turn on light during the day to recharge them. Our experience has shown that with five cells it works entirely automatic. We supply between sixty and seventy transmitters.

MR. GIFFORD—How many transmitters will one cell energize during 24 hours?

MR. WILSON—The arrangement we have contemplates 100 transmitters. We are only operating 60.

MR. BAILEY—How many transmitters do you couple on to one cell?

MR. WILSON—At the present time it is about 12, and we adjust the resistance until the current in each transmitter is all that it will stand.

MR. GIFFORD—What is the size of the battery which you use?

MR. WILSON—I cannot answer that. I simply authorized the purchase of a storage battery. We use the Edison current for ringing instead of the small generators.

MR. BAILEY—Do you have any difficulty with the variation of current which the Edison company furnishes?

MR. WILSON—No, sir. On one occasion the current was cut off for about ten minutes.

MR. BAILEY—I have found that the current from all these incandescent plants differs frequently. Where they are supposed to carry 100 volts to 110 volts they will vary from 90 to 130.

MR. WILSON—The Edison Company have a very large plant in Chicago and they supply motors. The Western Union Company use the Edison current for operating their dynamos, and I think the service gives satisfaction.

MR. GIFFORD—Mr. Forbes uses the same method in the exchange here.

MR. HIBBARD – In watching the generators in the Detroit Exchange this morning they had three lamps in the open circuit, and you could tell the number of operators ringing at a time by the way the lamps went down and came up and became bright again. They had an electro-motor turning the commutator, and their old equipment for running the ordinary power generator.

MR. WILSON—I would say also that 12 transmitters is the maximum, because the more transmitters you connect on a different cell the more current is absorbed from that cell, and you want to adjust the number of transmitters so that the cell will last the 24 hours, or until the lights are turned on again to recharge them. If you are burning lights during the day, with that arrangment it would not be necessary to use so many cells. We found that when we added any more transmitters it would be necessary during the day to turn on some lights to restore the charge drawn from them.

MR. FARNHAM—Don't you have a battery in reserve in case of accident?

MR. WILSON—Yes, sir. We propose to have a reserve series of storage cells, and in keeping them stored all the time we will be entirely independent of the source of supply. They will retain the charge indefinitely.

MR. BAILEY—Why wouldn't it be practicable to supply transmitters directly from incandescent mains without the intervention of storage batteries?

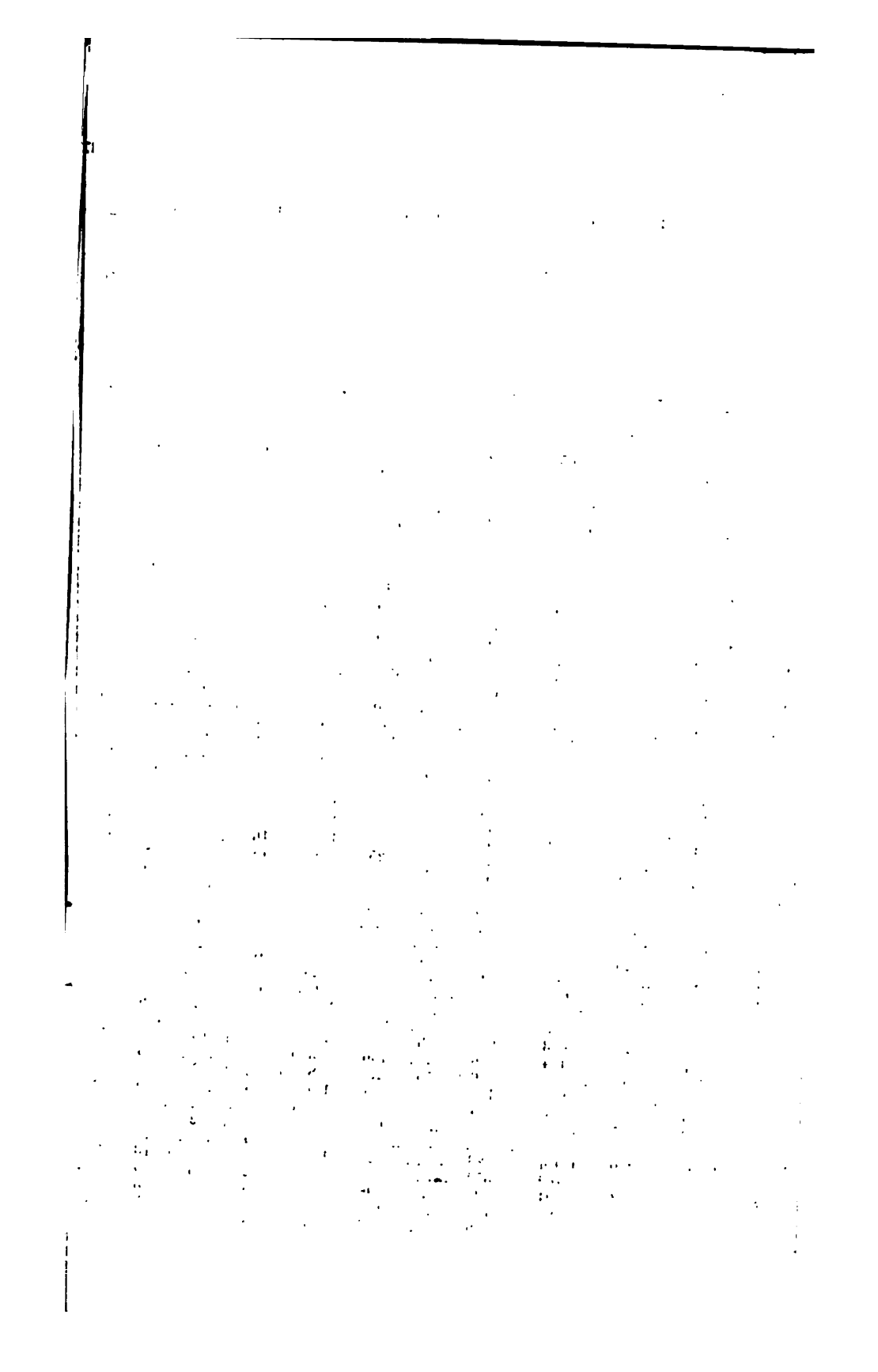
MR. WILSON—The Edison current itself is not smooth enough, but by storing it in the storage battery little or no Edison current gets around through your transmitters, and then you get out of the storage battery a perfectly smooth current. I will also add that we are now arranging to take out of the American District plant, which is owned by us in Chicago, the battery which is there—and we now have from 10 to 100 cells of gravity battery located in those offices through the city—and we are arranging to substitute a similar arrangement for all those offices.

MR. BAILEY—The Pennsylvania R. R. Company takes current direct from the dynamos at Pittsburgh and Harrisburgh and uses the storage batteries at Altoona They get very satisfactory current for telegraphic purposes without the intervention of batteries.

THE PRESIDENT—The hour of adjournment has passed.

THE SECRETARY—I wish to say that in accordance with the duty of the Secretary he has prepared the usual statistical report, compiled from reports furnished by different companies forming the membership of the Association. Of course, it is very long to read, and, as it consists largely of figures, it could not be followed if read; if there is no objection I will simply report now that I have prepared it, and will print it in the proceedings as has been customary.

THE PRESIDENT—If there is no objection, that course will be taken.



THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office,
NEW YORK CITY, September 2, 1890.

To the President and Members of the Association:

GENTLEMEN—In accordance with the By-Laws which define the duties of my office, I have prepared and have the honor to present the following report upon "Exchange Statistics" for the year.

On the 25th of June, last, the following circular was addressed by me to all the companies composing the membership of the Association, viz.:

THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION,
Secretary's Office, No. 510 West 23d Street,
NEW YORK, June 25, 1890.

"CIRCULAR:

"The work of preparing for the Annual Meeting of this Association, the Report upon Exchange Statistics will soon demand the attention of the Secretary. This report, covering as it does the important features in the operation of every exchange, has become more valuable each year for the purpose of comparison, and will farther increase in value and interest if the full co-operation of all the exchanges can be obtained in this work.

"It is requested that the blanks opposite the questions to be found on the inside pages of this circular be filled up, and the report returned to this office by July 25th next, in order to give sufficient time for the work of compiling the statistics. For the sake of uniformity it is suggested that the information as to number of daily connections, etc., be procured on the 8th, 9th and 10th of July.

"The circumstances surrounding the operation of small exchanges differ so greatly as to afford no common basis of comparison, which is the object to be attained, therefore no reports need be made from exchanges having less than 500 subcribers.

"Any additional blanks required, or explanation of the questions asked, will be cheerfully furnished.

"C. H. BARNEY,
Secretary."

In response to this request, 24 companies have sent in reports covering 47 exchanges and representing 71,220 subscribers.

The first report to arrive was from the Cumberland Telephone and Telegraph Company of Nashville, Tenn., on July 17th, and the last one was received August 28th.

As in previous years, the results of the reports received will appear in a series of comparative tables.

Table No. 1 represents the number of subscribers, the increase over last year, and the present ratio of subscribers to the population.

TABLE No. 1.

EXCHANGE SUBSCRIBERS.

Cities.	Population.	Subscribers in 1890.	Increase over 1889.	Present Ratio 1 to every	Subscribers in 1889.	Subscribers in 1888.	Subscribers in 1887.	Subscribers in 1886.	Subscribers in 1885.	Subscribers in 1884.	Subscribers in 1883.	Subscribers in 1882.
Albany	93,000	1403	†	66	....	1340	1258	....	...	...	....	....
Atlanta	66,200	1006	29	65	977	960	862	....	....	....	....	....
Baltimore	432,000	2293	23	144	2270	2261	2105	1863	1630	1450	1220	1017
Bay City	28,000	526	15	53	511	....	....	....	....	....	....	....
Boston	450,000	3767	381	119	3386	2288	2130	1857	1696	...	....	....
Bridgeport	48,000	681	†	70	....	614	....	....	..	....	....	....
Brooklyn	840,000	3873	249	216	3624	3569	3297	2797	2354	1846	1601	801
Cleveland	260,000	2613	226	99	2387	....	....	....	....	....	....	....
Columbus	90,000	1364	160	66	1204	1125	....	....	....	....	....	....
Davenport	33,000	737	27	44	710	697	....	....	....	....	....	....
Dayton	63,000	746	62	84	684	610	....	....	....	....	....	....
*Des Moines	50,000	633	7	79	640	726	....	....	....	....	....	....
Denver	125,000	1463	†	85	....	945	840	779	751	723	680	620
Detroit	203,000	3326	214	61	3112	2853	2585	2285	1956	1700	1474	....
East Saginaw	46,000	728	51	63	677	632	563	517	....	....	....	....
Galveston	30,000	513	†	58	...	..	....	....	....	...	....	....
Grand Rapids	60,000	1283	106	46	1177	1017	872	578	...	....	....	....
Hartford	52.000	745	†	69	....	868	824	..	....	....	..	....
Indianapolis	110,000	1183	222	93	961	....	..	....	....	....	....	....
Jersey City	224,000	911	19	246	892	865	769	693	648	391	346	....
Lincoln	55,000	670	58	82	612	....	....	....	....	....	....	....
Louisville	175,000	2183	180	80	2003	1876	1661	1436	1271	..	....	....
Milwaukee	206,308	2278	198	90	2080	1908	1732	1516	1375	1163	960	....
Minneapolis	185,000	1682	125	110	1557	....	1387	....	....	..	....	....
Nashville	72,400	1538	†	47	....	....	....	....	....	....	....	....
Newark	182,000	1011	60	180	951	907	732	....	....	....	....	....
New Haven	85,000	1179	18	72	1161	1212	1227	....	....	....	....	....
New Orleans	241,500	1185	27	203	1158	1148	1100	1163	....	....	....	....
New York	1,700,000	8224	358	206	7866	7300	6881	6043	5252	4808	4158	3451
Omaha	134,000	1513	81	88	1432	1166	....	....	....	....	....	....
*Paterson	78 000	553	5	141	558	541	642	640	651	551	473	....
Pawtucket	27,000	600	39	45	561	521	....	....	....	....	....	....
Peoria	42,000	619	25	68	594	....	....	....	....	....	....	....
Philadelphia	1,040,000	2901	161	357	2740	2564	2420	....	....	....	....	....
Pittsburgh	254,898	3433	467	74	2966	2618	2286	1951	1688	...	....	...
Providence	133,000	2616	175	51	2441	2280	2417	3168	2802	1892	1745	....
Reading	58,500	562	34	104	528	532	503	563	557	....	....	...
Richmond	80,000	825	57	97	768	675	593	506	427	354	347	....
St. Paul	145,000	1337	74	108	1263	....	1025	....	...	....	....	....
San Antonio	40.000	515	†	77	....	....	...	....	....	....	....	....
Scranton	76,500	750	†	102	...	679	617	573	...	....	....	....
Springfield, Ill	24,725	605	45	41	560	554	....	....	....	....	....	....
Toledo	73,000	1087	70	67	1017	989	....	....	....	....	....	....
Washington	232 000	1600	109	145	1491	....	1362	1272	1183	872	....	....
Wilkesbarre	38,000	728	†	52	...	593	527	463	....	....	....	....
Williamsport	30,000	517	†	58	...	515	466	437	....	...	....	....
Wilmington	62,000	715	75	88	640	578	500	440	....	....	....	....

*Shows Decrease. †Did not Report in 1889.

The 37 exchanges in above table which reported last year, show in 1890, 62,637 subscribers as against 58,159 in 1889, a net gain of 4,208, or over seven per cent.

Although this is not as large a gain as last year, it will be noticed that only two exchanges report a loss of subscribers, Des Moines 7 and Paterson 5.

Last year 4 exchanges showed a loss amounting to 154 subcribers.

In proportion to the population, Springfield, Ill., has the greatest number of subscribers, the ratio being 1 to every 41, Davenport has 1 to every 44, Pawtucket 1 to 45, Grand Rapids 1 to 46, and Nashville 1 to 47.

Twenty-eight of the remaining exchanges show a ratio better than 1 to 100, nine better than 1 to 200, while but five show a greater ratio, as follows :

New Orleans	1	to every	203
New York	1	" "	206
Brooklyn	1	" "	216
Jersey City	1	" "	246
Philadelphia	1	" "	357

Table No. 2 shows the average number of daily connections.

TABLE NO. 2.

DAILY CONNECTIONS.

	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Albany	8,674	.....	7,421	6,080	.....	.....	.....	.....	.....	.....
Atlanta	10,481	14,000	10,175	8,517	.....	.....	.....	.....	.....	.....
Baltimore	23,923	24,331	48,132	19,275	12,500	10,481	.....	.....	.....	.....
Bay City	5,979	6,150	.....	.....	.....	.....	.....	.....	.....	.....
Boston	43,178	42,607	1,400	17,345	12,043	10,385	.....	4,741	.....	.....
Brooklyn	22,832	19,965	18,821	17,508	14,675	10,809	5,508	5,290	.....	.....
Bridgeport	4,125	.....	3,509	.....	.....	.....	.....	.....	.....	.....
Buffalo	.....	6,412	7,938	7,060	6,485	5,980	5,480	22,000	3,842	2,304
Chicago	.....	.....	.....	44,292	32,996	31,368	27,101	.....	16,044	16,136
Cincinnati	.....	45,000	45,000	45,000	.....	.....	.....	4,179	.....	.....
Cleveland	28,559	22,067	.....	.....	.....	.....	.....	.....	.....	.....
Columbus	14,848	8,530	9,600	.....	.....	.....	.....	.....	.....	.....
Davenport	5,604	4,783	4,650	.....	.....	.....	.....	.....	.....	.....
Dayton	6,109	5,707	4,604	.....	.....	.....	.....	.....	.....	.....
Denver	12,783	.....	5,938	5,230	4,528	4,467	5,298	.....	3,450	.....
Des Moines	4,265	4,947	5,778	.....	.....	.....	.....	.....	.....	.....
Detroit	37,197	39,428	32,507	33,146	31,723	20,800	.....	.....	.....	.....
East Saginaw	8,628	5,992	5,653	7,330	.....	.....	.....	.....	.....	.....
Galveston	3,477	.....	.....	.....	.....	.....	.....	.....	.....	.....
Grand Rapids	11,947	9,845	7,497	6,800	.....	.....	.....	.....	.....	.....
Hartford	3,003	.....	4,006	3,692	.....	.....	.....	.....	.....	.....
Indianapolis	13,144	7,500	.....	.....	.....	.....	.....	.....	.....	.....
Jersey City	7,093	3,870	6,600	4,222	4,000	.....	.....	.....	.....	.....
Lincoln	4,970	3,665	.....	.....	.....	.....	.....	.....	.....	.....
Louisville	22,000	20,000	16,500	13,200	12,000	.....	.....	.....	.....	.....
Lowell	.....	.....	3,000	2,640	2,265	.....	.....	.....	.....	.....
Los Angeles	.....	4,300	6,000	.....	.....	.....	.....	.....	.....	.....
Milwaukee	11,904	12,326	9,843	6,548	6,031	4,461	.....	.....	.....	.....

DAILY CONNECTIONS.—*Continued.*

	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.	1881.
Minneapolis....	12,926	10,702	.....	16,000	.....	.....	.....	.....	.....	.....
Newark.....	4,509	3,959	3,996	2,705	.....	.....	.....	.....	.....	.....
New Haven...	5,540	4,584	5,500	6,253	.....	.....	.....	.....	.....	.....
New Orleans..	8,670	9,650	9,554	8,002	7,381	6,791	.....	.....	.....	.....
New York.....	103622	61,684	64,352	84,750	42,003	36,153	25,912	25,891	19,727	.....
Omaha.....	14,000	12,622	8,999	.....	.....	.....	.....	.....	.....	.....
Paterson.....	2,729	2,587	3,020	2,383	2,800	.....	.....	.....	.....	.....
Pawtucket.....	4,000	4,010	5,880	.....	.....	.....	.....	.....	.....	.....
Peoria.....	9,158	5,746	7,234	.....	.....	.....	.....	.....	.....	.....
Philadelphia...	21,278	20,371	17,905	17,098	.....	.....	.....	.....	.....	.....
Pittsburgh.....	26,748	16,586	16,000	18,492	14,435	11,583	.....	.....	.....	.....
Portland, Me..	....	4,000	4,600	3,354	.....	.....	.....	.....	.....	.....
Portland, Or..	.....	2,700	2,000	.....	.....	.....	.....	.....	.....	.....
Providence....	18,647	16,027	13,229	12,140	14,423	12,046	.....	.....	.....	.....
Reading.....	3,136	2,850	3,268	2,239	2,500	.....	.....	.....	.....	.....
Richmond.....	14,173	13,183	.....	7,651	4,307	4,072	3,013	.....	.....	.....
Rochester.....	.....	3,709	.....	.....	.....	.....	.....	.....	.....	.....
San Antonio...	4 524	.....	.....	.....	.....	.....	.....	.....	.....	.....
St. Paul.....	8,989	7,005	.....	9,000	.....	.....	.....	.....	.....	.....
St. Joseph.....	.....	6,000	7,563	.....	.....	.....	.....	.....	.....	.....
San Francisco..	.....	5,000	5,000	.....	.....	.....	.....	.....	.....	.....
Scranton.....	3,780	.....	3,219	3,238	.....	.....	.....	.....	.....	.....
Springfield, Ill.	4,213	4,955	4,472	.....	.....	.....	.....	.....	.....	....
Springf'd, Mass	.....	2,739	2,783	2,471	.....	.....	.....	.....	.....	.....
Syracuse.....	.....	.....	7,158	.....	.....	.....	.....	.....	.....	.....
Toledo.....	14,427	11,712	7,658	.....	.....	.....	.....	.....	.....	.....
Topeka.....	.....	2,400	.....	.....	.....	.....	.....	.....	.....	.....
Utica.....	...	.....	2,731	.....	.....	.....	.....	.....	.....	.....
Washington,...	9,376	8,592	7,597	6,219	6,705	3,939	2,782	.....	.....	.....
Wilkesbarre....	3 766	.....	2,900	3,274	.....	.....	.....	.....	.....	.....
Williamsport...	3,460	.....	2,608	2,600	.....	.....	.....	.....	.....	.....
Wilmington....	6,000	5,637	5,290	4,756	.....	.....	.....	.....	.....	.....
Worcester.....	.....	3,600	3,475	2,150	2,450	.....	.....	.....	.....	.....

In the thirty-seven exchanges which can be compared with 1889, the number of connections has increased from 467,473 last year to 572,898 in 1890, a net increase of 105,425, over 22 per cent.

The increase in business is most marked in the following exchanges: New York, Indianapolis, Pittsburgh, Jersey City, Peoria, East Saginaw, Cleveland and Columbus, while Atlanta, and Springfield, Ills., are the only places where the decrease is noticeable.

In Table No. 3 is shown the average daily calls per subscriber, which should, of course, be doubled to show the use of the telephone by each subscriber.

TABLE NO. 3.

CALLS PER SUBSCRIBER.

Exchanges.	1890.	1889.	1888.	1887.	1886.	1885.	1884.
Albany	6.1	.....	4.7	4.8	.....	.....	.....
Atlanta	10.4	14.3	10.5	9.8	.....	.....	.....
Baltimore	10.4	10.7	12.	9.1	6.7	7.	6.8
Bay City	11.3	12.	.. ..	.....	.....	.....	.....
Boston	11.5	12.5	6.	8.1	6.5	6.	.....
Bridgeport	6.	.....	5.7	.....	.. ...	.....	.....
Brooklyn	5.8	5.5	5.3	5.3	5.2	4.5	3.6
Buffalo	... ..	3.5	4.4	3.9	3.8	3.9	4.3
Chicago	.....	.....	.....	9 6	8.1	8 6	3.4
Cincinnati	.....	13.3	4.7	15.5	5.8	6.	7.3
Cleveland	10.9	9.2	.....	.....	.....	.....	.....
Columbus	11.1	7.1	8.5	.....	.....	.....	. ....
Denver	8.7	.....	6.2	6.2	.....	.....	.....
Detroit	11.1	12.6	11.3	12.8	13.8	10.6	.....
Davenport	7.6	6.7	6.7	.....	.....	.....	.. ...
Dayton	8.1	8.3	7.5	.....	.....	.....	.....
Des Moines	6.7	7.7	5.3	.....	.....	.....	.....
East Saginaw	11.8	8.8	8.9	13.	.....	... ..	.....
Galveston	6.7	.....	.....	.....	....	.....	.....
Grand Rapids	9.3	8.3	7.3	7.8	.....	.....	.....
Hartford	4.	.....	4.6	4.5	.....	.....	.....
Indianapolis	11.1	7.8	.....	.....	.....	.....	.....
Jersey City	7.7	4.3	7.6	5.4	5.7	.....	.....
Lincoln	7.4	5.9	.....	.....	.....	.....	.....
Lowell	.....	.....	4.5	4.1	3.8	.....	. ....
Los Angeles	... ..	3.9	5.8	.....	.....	.....	.....
Louisville	10.1	10.	8.7	7.9	8.3	.....	.. ...
Milwaukee	5.2	5.9	5.1	3.7	3.9	3.2	.....
Minneapolis	7.6	6.8	.....	11.5	.....	.....	.....
Newark	4.4	4.2	4.2	3.6	.....	.....	.....
New Haven	4.6	3.9	4.5	5.	.. ...	.....	.....
New Orleans	7.3	8.3	8.2	6.9	6.6	5.9	.....
New York	12.6	7.8	8 8	12.3	6.5	7.	5.1
Omaha	9.2	8.8	7.7	.....	.....	.....	.....
Paterson	4.9	4.6	5.5	3.7	4 3	.....	.....
Pawtucket	6.6	7.1	11.2	.....	.....	... ..	.....
Peoria	14.7	9.6	.....	.....	.....	.....	. ....
Philadelphia	7.3	7.4	6.5	7.1	.....	.....	.....
Pittsburgh	7.8	5.6	6.1	8.1	7.3	6.8	.....
Portland, Maine	.....	5.	5.9	4.5	.....	.....	.....
Portland, Oregon	... ..	4.1	3.6	.....	.....	.....	.....
Providence	7.1	6.6	6.5	5.	4.5	5.2	5.
Reading	5.5	5.4	6.	4.4	4.4	.. ...	.....
Richmond	17.1	17.1	.....	12.9	8.5	9.5	8.8
Rochester	.. ..	4.4	.....	.....	.....	.....	.....
San Antonio	8.7	.....	.....	.....	.....	.....	.....
St. Paul	6.7	5.5	.....	8.7	.....	.....	.....
St. Joseph	.....	8.7	11.8	.....	... ..	.....	.....
Scranton	5.	.....	4.7	5.2	.....	.....	.....
Springfield, Mass	.....	4.2	4.5	4.3	.....	.....	.....
Syracuse	.....	.....	8.8	.....	.....	.....	.....

CALLS PER SUBSCRIBER.—*Continued.*

Exchanges.	1890.	1889.	1888.	1887.	1886.	1885.	1884.
San Francisco	.....	1.6	1.8	.....	.....	.....	.....
Springfield, Ill	6.9	8.8	7.1	.....	.....	.....	.....
Toledo	13.2	11.5	7.7	.....	.....	.....	.....
Topeka	.....	4.8	.....	.....	.....	.....	.....
Utica	.....	.....	4.2	.....	.....	.....	.....
Washington	5.8	5.9	1.8	4.5	5 2	3.5	.....
Wilkesbarre	5.1	.....	4.8	6.2	.....	.....	.....
Wiliamsport	6.7	.....	4.	5.5	.....	.....	.....
Wilmington	8.3	8.8	9.	9.5	.....	.....	.....
Worcester	.....	4.2	4.4	3.4	3.7	.....	.....

Forty-six exchanges have reported, and thirty-seven can be compared with last year.

Richmond, as in 1889, shows the highest average, 17.1.

Peoria comes next with 14.7, closely followed by Toledo, with 13.2.

The lowest average is reported by Hartford, being 4.

Twenty-three exchanges show an increase, thirteen a decrease, and one (Richmond) shows the same average as last year.

Table No. 4 shows the number and percentage of connections which are lost or delayed from various causes, such as "busy," "don't answer," and "in trouble."

Of the thirty-five exchanges reporting, Peoria shows the largest percentage of lost connections, 15.5, and Milwaukee, the smallest, three-tenths of one per cent.

TABLE NO. 4.

LOST OR DELAYED CONNECTIONS.

Exchanges.	1890.		1889.		1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Albany	601	6.9	....	....	368	4.9	465	7.6	....	....	....	....	.....	....
Atlanta	....	....	409	2.9	350	3.4	200	2 3	....	....	....	....	.....	....
Baltimore	3062	12.8	3062	12 5	1224	2.5	1224	6.3	900	7.2	900	9	800	8.
Bay City	397	6.6	741	12.	....	....	....	....	....	....	....	....	....	....
Boston	1500	4.2	538	1.2	38	2.	....	....	1021	8.5	618	5.	.....	....
Brooklyn	1488	6.5	860	4.3	1375	7.5	1363	7.8	817	5.6	506	5.	634	11.
Buffalo	....	....	402	6.3	755	9.5	527	7.5	421	6.5	416	7.	520	9.
Bridgeport	278	6.7	....	....	....	....	....	....	....	....	....	....	....	....
Chicago	....	....	....	....	....	....	4326	9.8	3852	17.	2759	8.7	1355	5.
Cincinnati	....	....	750	1.6	700	1.5	500	1.1	....	....	....	....	.....	....
Cleveland	3000	10 6	2630	11.9	....	....	....	....	....	....	....	....	....	....
Davenport	322	5.7	....	....	173	3.7	....	....	....	....	....	....	....	....
Dayton	400	6.5	275	4.8	3	6.5	....	....	....	....	....	....	....	....
Denver	....	....	....	....	....	....	208	4.	186	4.1	....	.6	....	....
Des Moines	175	4.1	....	....	300	5 2	....	....	....	....	....	....	....	....

LOST OR DELAYED CONNECTIONS.—*Continued.*

Exchanges.	1890.		1889.		1888.		1887.		1886.		1885.		1884.	
	No. Daily.	Per. Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.	No. Daily.	Per Cent.
Detroit.....	4126	11.0	1420	3.6	2808	8.6	3209	9.7	2100	6.6	2120	10.	....	...
East Saginaw.	590	6.8	425	7.1	420	7.4	443	6.	263	....	....	..	....	...
Grand Rapids.	1114	9.3	862	8.7	657	8.7	645	9.5	617	...	....	....	....	...
Galveston	159	4.5	....	....	....	....	....	....	....	....	....	....	....	...
Hartford.	227	7.5	....	....	....	....	100	2.7	....	....	...	....	....	...
Indianapolis ..	1500	11.4	780	10.4	....	....	....	....	....	....	....	....	....	...
Jersey City...	933	11.7	354	9.1	174	2.6	269	6.4	200	5.	....	...	...	...
Louisville est'd	3300	15.0	3000	15.0	128	10.	est'd	10.	est'd	10.	....	....	....	...
Lowell.....	....	....	....	....	300	10.	75	2 8	195	8.6	....	. .	....	...
Los Angeles..	....	....	62	1.4	...	....	....	....	..	....	....	....	...	...
Milwaukee ...	35	0 3	30	0.2	42	4.2	994	15.2	2052	34.	892	20.	...	...
Minneapolis ..	....	....	1302	12.1	....	....	1600	10.	....	...	....	..	...	...
Newark.....	410	9.0	250	6.3	20	0.55	40	1.5	....	....	....	....		...
New Haven..	579	10.4	488	10.6	150	2.7	950	15.2	....	....	....	....	....	...
New Orleans..	500	5.7	350	3.5	440	4.6	450	5.6	600	8.1	426	6.5	....	....
New York...	4871	4.7	4648	7.5	1639	2.5	443	.5	2180	5.5	1959	5.	1789	8.
Omaha.....	....	....	....	....	260	2 9	....	. .	....	....	....	....	....	...
Peoria	1420	15.5	490	8.5	398	5.5	....	...	....	....	....	....	....	...
Paterson	40	1.4	30	1.2	70	2.2	216	9.1	125	4.5	....	....	....	...
Pittsburgh....	2426	9.	1544	9.3	1140	7.	1735	9.4	1397	9.7	1085	10.	....	...
Portland, Me..	....	....	300	7.5	450	....	263	7.8	238	....	....	....	....	...
Portland, Ore'n	....	....	40	1.5	....	....	....	....	....	....	....	....	....	...
Providence ...	2234	11.9	....	....	....	...	....	....	....	....	....	....	...	...
Reading.....	210	6.6	50	1.7	500	10.5	268	12.0	150	.6	....	....	...	...
Richmond....	300	2.1	250	1.8	....	....	....	....	....	....	....	....	....	...
Rochester	....	....	91	2.4	....	....	....	....	....	....	....	....	....	...
San Antonio.	276	6.1	....	....	....	....	....		....	....	....	....	....	...
San Francisco.	....	....	120	2.4	....	....	....	....	....	....	....	....	....	...
St. Paul.. ...	....	....	400	5.7	...	....	900	10.	....	....	....	....	....	...
St. Joseph....	....	....	300	5.	....	....	....	....	....	....	....	....	....	...
Scranton	80	2.1	....	....	289	8.9	171	5.3	195	....	....	....	...	...
Springfield, Ill	....	....	125	2.5	1040	23.2	....	....	....	....	....	....	....	...
Springf'd, Mass	...	...	145	5.2	183	6.5	119	4.8	113	....	....	....	....	...
Toledo.....	1769	12.2	8 0	7.2	760	9.6	....	...	...	....	....	....	....	...
Utica	...	....	...	...	268	9.8	....	....	....	....	....	....	....	...
Washington ..	820	8.7	757	8.8	634	8 3	576	9.3	738	11.	777	1.9	602	20.
Wilkesbarre ..	456	12.1	..	....	619	10.6	175	5.3	62	...	....	....	....	...
Williamsport..	490	14.2	....	...	266	10.2	250	9.6	158	....	....	....	....	...
Wilmington ..	....	....	....	.....	...	....	234	4.9	....	....	....	. ..	....	...
Worcester....	....	....	275	7.6	275	7.9	175	7.1	125	5.1	....	....	.....	...

Table No. 5 exhibits the average number of connections made by each subscriber operator, daily, between the hours of 8 A. M. and 6 P. M.

TABLE NO. 5.

DAILY CONNECTIONS PER OPERATOR.

Exchanges.	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881
Albany	506	....	449	429	....	....	....	..	....	....
Atlanta	770	812	608	746	...	....	....	....	...	....
Baltimore	862	874	1132	788	595	390	....	....	....	...
Bay City	530	570	....	....	....	....	....	....	....	....
Boston	1129	1039	...	788	514	375	...	....	....	....
Brooklyn	456	376	214	384	367	277	177	132	....	....
Bridgeport	510	....	394	....	....	....	....	....	....	....
Buffalo	....	323	276	269	233	233	221	263	148	...
Chicago	....	....	....	328	300	290	271	202	161	....
Cincinnati	....	843	650	522	....	...	....	....	....	....
Cleveland	956	849	....	....	...	..	....	....	....	....
Columbus	898	710	788	....	....	....	....	....	....	...
Davenport	560	386	500	....	....	....	....	....	....	..
Dayton	766	714	685	..	....	....	....	....	....	....
Denver	796	....	315	319	269	291	360	379	246	...
Detroit	581	691	676	942	70,	710	....	..	....	....
Des Moines	627	530	428	...	....	....	...	....	....	....
East Saginaw	832	385	319	732	643	....	....	....	...	....
Galveston	594	....	....	....	...	..	....	....	....	..
Grand Rapids	394	388	485	469	372	....	...	....	....	....
Hartford	156	....	293	310	....	....	....	....	....	....
Indianapolis	830	616	....	....	....	....	....	....	....	....
Jersey City	369	224	265	388	400	....	....	....	....	....
Lincoln	485	523	....	....	...	....	....	....	....	....
Louisville	833	816	674	612	633	....	..	....	....	....
Lowell	....	....	438	440	324	....	....	....	....	....
Los Angeles	....	530	..	....	....	....	....	....	....	....
Milwaukee	581	685	468	345	335	281	203	269	.	....
Minneapolis	718	618	....	960	..	...	....	....	....	....
Nashville	1800	....	....	....	....	....	....	....	....	....
Newark	297	255	215	116	..	...	....	...	....	....
New Haven	508	420	308	338	.	....	....	....	....	....
New Orleans	793	1114	1127	1073	1054	848	....	...	...	....
New York	504	447	647	895	200	225	145	120	114	....
Omaha	758	464	649	....	....	....	....	....	....	....
Paterson	443	468	437	303	400	...	...	....	....	....
Pawtucket	650	1000	728	...	....	...	....	....	....	....
Peoria	1340	876	541	....	...	....	....	....	....	....
Philadelphia { Law	626	..	}							
Philadelphia { Mag	300	..	}	469	465	....	....	...	..	...
Pittsburgh	535	333	330	569	504	526	....	....	..	...
Portland, Me	....	390	400	305	327	....	....	..	....	....
Portland, Oregon	....	417	330	.	....	....	....	....	....	....
Providence	846	727	692	301	280	335	....	...	....	...
Reading	587	518	453	334	355	....	....	....	....	....
Richmond	1219	1163	....	1028	....	....	....	....	...	....
Rochester	....	475	....	....	....	....	....	....	....	....
San Antonio	565	....	....	....	....	....	....	...	....	....
San Francisco	...	265	....	....	...	....	....	....	....	....
St. Paul	648	253	....	304	....	....	....	....	....	....

DAILY CONNECTIONS PER OPERATOR—*Continued.*

Exchanges.	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881
St. Joseph	....	786	1101	...	....	....	....	....	..	....
Scranton	425	....	402	405	620	....	....	....	....	...
Springfield, Ill	608	666	584	....	...	....	....	....	....	....
Springfield, Mass	....	342	306	305	293	....	....	....	....	....
Syracuse	....	....	988	....	....	....	....	....	....	....
Toledo	1298	488	765	....	....	....	....	....	....	....
Topeka	....	480	....	....	....	....	....	....	....	....
Utica	....	....	390	....	....	....	....	....	....	....
Washington	617	556	521	530	637	387	....	..	....	....
Wilkesbarre	549	....	580	444	469	..	....	....	....	....
Williamsport	396	....	522	325	401	...	....	....	....	....
Wilmington	....	.	881	910	...	....	...	....	....	....
Worcester	...	533	326	237	306	...	....	....	....	....

Of the forty-six exchanges reporting, Nashville claims 1,800 calls per day answered by each operator.

Next comes Peoria, with an average of 1,340, followed by Toledo, with 1,298, Richmond, 1,219, and Boston, 1,129.

Hartford has the smallest average, the operators there answering only 156 calls each daily.

In twenty-five exchanges the operators are reported as doing more work than a year ago, while in ten the work is less.

Table No. 6 shows the number of wires taken care of by each operator.

TABLE NO. 6.

SUBSCRIBER'S WIRES PER OPERATOR.

Exchanges.	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.
Albany	90	.....	83	77	.....	.....	.....	.....
Atlanta	66	59	75	85	.....	.....	.....	.....
Baltimore	66	65	66	98	67	71	85	30
Bay City	48	47	.....	.....	.....	.....	.....	.....
Boston	97	82	90	95	88	63	.....	.....
Brooklyn	86	80	70	74	72	71	68	48
Bridgeport	48	.....	39	.....	.....	.....	.....	.....
Buffalo	... .	88	63	62	57	70	67	67
Chicago	.....	.....	.....	34	37	33	34	31
Cincinnati	... .	57	53	37	.....	.....	.....	... ..
Cleveland	95	87	.....	.....	.. ...	.....	.....	.....
Columbus	100	100	100	.....	.....	.....	.....	... ..
Davenport	80	63	100	.....	.....	.....	.....	.....
Dayton	100	91	100	.....	.....	.....	.....	.....
Denver	98	.....	53	52	48	.....	.....	.....
Des Moines	100	91	90	.....	.....	.....	.... .	.....
Detroit	30	54	39	76	71	70	.....	.....
East Saginaw	71	55	38	38	55	.....	.....	.....
Galveston	101	.....	.....	.....	.. ...	.....	.....	.....
Grand Rapids	50	50	43	60	57	.....	.....	.....

SUBSCRIBER'S WIRES PER OPERATOR—*Continued.*

Exchanges.	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.
Hartford	24		28	33				
Indianapolis	86	77						
Jersey City	61	49	46	58	64			
Lincoln	95	87						
Louisville	87	86	100	71	70			
Lowell			33	42	37			
Los Angeles		148	150					
Milwaukee	88	94	78	76	71	91	64	46
Minneapolis	85	76		62				
Nashville	116							
Newark	80	64	54	46				
New Haven	67	51	30	73				
New Orleans	124	150	153	157	142	144		
New York	56	60	79	84	91		66	
Omaha	100	57	100					
Paterson	92	93	74	76	75			
Pawtucket	60	57	26					
Peoria	103	100	100					
Philadelphia	Law.78 Mag.33	70	60	56				
Pittsburgh	61	59	50	65	62	65		
Portland Me		36	33	38	37			
Portland, Oregon		108	100					
Providence	61	56	51	28	35	35		
Reading	66	64	54	57	44			
Richmond	81	76	83	84	128	108	88	
Rochester		95						
San Antonio	73							
San Francisco		140						
St. Paul	72	33		38				
St. Joseph		100	100					
Scranton	37		38	32	47			
Springfield, Ill	100	93	100					
Springfield, Mass		37	31	71	67			
Syracuse			80					
Toledo	97	66	95					
Topeka		100						
Utica			79					
Washington	81	80	79	80	79	126		
Wilkesbarre	45		45	34	53			
Williamsport	46		53	44	64			
Wilmington		85	89	90	92			
Worcester		63	35	34	34			

Thirty-two multiple boards show an average of 78.7 wires per operator, twelve straight average 75 wires to each operator.

The multiple average is about the same, and the straight somewhat greater than last year.

Table No. 7 shows the number of trunk toll lines.

TABLE NO. 7.

NUMBER OF TRUNK TOLL LINES.

Exchanges.	1890.	1889.	1888.	1887.	1886.	1885.	1884.	1883.	1882.
Albany	24		24	24					
Atlanta	2	4	3						
Baltimore	20	20	20	18	17				
Bay City	10	9							
Boston	52	253	177	213	183	152			
Brooklyn	132	257	239	221	175	126	104	89	
Bridgeport	13		13						
Buffalo			59	57	57	45	37	26	21
Chicago				369	366	355	254	245	228
Cincinnati		262	261	260					
Cleveland	10	75							
Columbus	12								
Davenport	17		17						
Dayton	13		15						
Detroit		57	50	37	30	20			
Des Moines	9								
East Saginaw	11	10	12	10	4				
Hartford	24		18	16					
Indianapolis	15								
Jersey City	73	85	84	69	67				
Louisville	11	11	11	12	2				
Lowell			12	12	12				
Minneapolis	16			14					
Nashville	18								
Newark	41	50	41	23					
New Haven	16	28	19	20					
New York	193	669	742	755	600	520	491	331	274
Omaha	13								
Paterson	16	15	17	21	26				
Pawtucket		19	19						
Peoria	15								
Philadelphia	8	51	62	60					
Pittsburgh	120	114	82	78	47	39			
Portland, Me		5	5	5	6				
Portland, Oregon		3							
Providence	11	48	47	39	32	37	42	38	48
Reading	5	6	5	9	5				
Richmond	2	1	1						
St. Paul	16			16					
San Francisco		69	43						
Scranton	3		1	2	2				
Springfield, Mass.		16	15	13	12				
Springfield, Ill.	14								
Toledo	13								
Utica			16						
Washington	22	18	13	4	5				
Wilkesbarre	5		5	7	7				
Williamsport	4		4		2	2			
Wilmington	8	8	8	6	6				
Worcester		18	23	12	8				

In previous years the question from which this table has been made was worded "Number of Trunk Lines;" this year it was changed to "Number of Trunk *Toll* Lines," and the introduction of the word "toll" has made quite a difference in the number of lines reported. For instance, New York reported last year 669, and this year only 193, the inference being that the remaining lines are used to connect subscribers in different central offices operated as a part of the same exchange without extra charge. The figures in Table No. 7, for 1890, represent, therefore, only those lines for the use of which the subscriber is made to pay an extra "toll."

TABLE NO. 8.

TRUNK TOLL LINE CONNECTIONS.—DAILY CONNECTIONS PER TRUNK TOLL LINE.

Exchanges.	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881
Albany	19	....	10	18	....	....	....	....	....	....
Atlanta	22	23	30	....	....	....	....	....	....	....
Baltimore	8	11	13	12	26	....	....	....	....	....
Bay City	30	43	....	....	....	....	....	....	....	....
Boston	17	44	....	27	24	....	....	....	....	....
Bridgeport	8½	....	....	....	....	....	....	....	....	....
Brooklyn	38	41	29	22	25	33	28	....	....	....
Buffalo	....	....	31	26	26	36	39	50	41	21
Chicago	....	....	....	75	61	56	38	....	....	....
Cincinnati	....	42	42	38	....	....	....	....	....	....
Cleveland	10	84	....	....	....	....	....	....	....	....
Columbus	19	....	....	....	....	....	....	....	....	....
Davenport	35	....	....	....	....	....	....	....	....	....
Dayton	20	....	....	....	....	....	....	....	....	....
Des Moines	11	....	....	....	....	....	....	....	....	....
Detroit	....	89	44	155	61	52	....	....	....	....
East Saginaw	55	71	81	....	....	....	....	....	....	....
Galveston	21	....	....	....	....	....	....	....	....	....
Hartford	5	....	....	....	....	....	....	....	....	....
Indianapolis	19	....	....	....	....	....	....	....	....	....
Jersey City	16	22	19	13	13	....	....	....	....	....
Louisville	16	20	50	40	40	....	....	....	....	....
Minneapolis	20	....	....	....	....	....	....	....	....	....
Newark	15	10	15	16	....	....	....	....	....	....
New Haven	20	19	11	27	....	....	....	....	....	....
New York	42	55	32	43	56	48	31	41	31	23
Omaha	29	....	....	....	....	....	....	....	....	....
Paterson	11	13	15	10	10	....	....	....	....	....
Pawtucket	....	45	....	....	....	....	....	....	....	....
Peoria	17	....	....	....	....	....	....	....	....	....
Philadelphia	20	....	....	....	....	....	....	....	....	....
Pittsburgh	....	53	54	69	74	111	....	....	....	....
Portland, Maine	....	75	54	8	11	....	....	....	....	....
Portland, Oregon	....	10	12	....	....	....	....	....	....	....
Providence	30	15	88	....	....	....	....	....	....	....
Reading	12	17	2	76	4	....	....	....	....	....
Richmond	5	25	....	....	....	....	....	....	....	....
San Francisco	....	35	40	....	....	....	....	....	....	....

TRUNK TOLL LINE CONNECTIONS—DAILY CONNECTIONS PER TRUNK TOLL LINE—*Continued.*

Exchanges.	1890	1889	1888	1887	1886	1885	1884	1883	1882	1881
San Antonio	19	....	....	....	....	....	....	...	....	....
Scranton	6	....	....	..	....	....	....	....	....	....
St. Paul	20	....	....	....	....	....	....	....	....	....
Springfield, Ill	6½	....	....	....	....	....	....	..	....	...
Springfield, Mass	....	16	9	13	9	..	....	....	....	....
Toledo	18	...	....	..	....	....	....	....	....	....
Washington	10½	20	78	16	8	....	...	....	....	....
Wilkesbarre	15	....	...	....	....	....	....	....	....	....
Williamsport	7	....	25	48	41	....	....	...	....	....
Wilmington	....	...	38	22	....	....	....	....	...	....
Worcester	...	7	75	80	..	....	....	...	....	....

A greater number of exchanges have reported on this point than in preceding years, and this, together with the restrictions heretofore mentioned as to "toll lines," has had the effect of lowering the general average.

The thirty-seven exchanges reporting this year, show an average of eighteen connections per day on each trunk line.

In 1889 twenty-six exchanges reported a daily average of thirty-nine.

East Saginaw has the highest average this year, 55, and Richmond and Hartford the lowest, 5 each.

Table No. 9 shows the number of "direct" and "circuit" wires at each exchange.

TABLE NO. 9.

DIRECT AND CIRCUIT WIRES.

Exchanges.	1890.		1889.		1888.		1887.		1886.		1885.	
	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit
Albany	1,180	73	....	...	1,130	65	1,087	60	....	...	....	...
Atlanta	986	9	942	12	907	13	821	10	...	...	....	...
Baltimore	1,289	411	1,314	386	1,197	464	1,078	372	1,007	404	831	388
Bay City	446	40	431	40	....	...	...	...	....	...	...	...
Boston	3,528	112	3,115	116	2,223	31	2,056	34	1,769	36	1,606	44
Brooklyn	3,541	86	3,276	80	2,944	195	2,705	170	2,157	195	1,734	237
Bridgeport	187	149	..	...	169	106	..	...	....	...	....	...
Buffalo	....	...	1,320	187	1,272	179	1,258	174	1,185	183	1,102	165
Chicago	....	...	...	...	....	...	4,577	...	4,067	...	3,630	...
Cincinnati	...	...	2,509	403	2,351	309	2,222	299	....	...	....	...
Cleveland	2,442	84	2,255	62	....	...	....	...	....	...	....	...
Columbus	1,234	46	1,050	50	1,005	42	....	...	...	...	....	...
Davenport	705	14	686	10	655	12	....	...	....	...	....	...
Dayton	684	16	627	16	562	12	....	...	....	.	....	...
Denver	1,412	6	640	...	853	39	740	44	717	9	715	10
Des Moines	630	3	...	...	726	...	.....	..	....	...	....	156

DIRECT AND CIRCUIT WIRES—*Continued.*

Exchanges.	1890.		1889.		1888.		1887.		1886.		1885.	
	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.	Direct.	Circuit.
Detroit	2,764	355	2,492	272	2,282	244	2,060	231	1,821	189	1,605	...
East Saginaw	581	63	559	49	479	55	345	153	390	53	....	...
Galveston	503	5	....	...	....	...	..	...	....	..	.....	...
Grand Rapids	1,104	70	1,013	63	892	41	738	48	638	45	....	...
Hartford	225	186	....	...	170	200	176	193	....	...	...	...
Indianapolis	1,124	59	922	16	....	...	...	...	....	...	.....	...
Jersey City	590	139	482	203	433	150	442	143	385	131	350	127
Lincoln	670	...	607	2	....	...	....	....	....	...	....	...
Louisville	1,567	251	1,257	329	1,077	347	776	434	675	372	730	371
Lowell	....	...	...	...	90	206	82	173	32	227	52	221
Los Angeles	....	...	995	45	922	44	....	...	....	...	...	...
Milwaukee	1,660	177	1,525	169	1,435	208	1,311	179	1,172	104	986	112
Minneapolis	1,119	241	1,029	193	....	...	579	287	....	...	....	...
Nashville	1,513	25	..	...	...	...	....	...	....	...	....	...
Newark	907	48	851	45	858	3	697	2	....	...	....	...
New Haven	365	266	264	250	226	274	214	261	....	...	....	...
New Orleans	1,064	56	972	80	1,002	73	1,034	47	995	73	975	84
New York	8,224	...	7,863	1	7,298	2	6,842	8	6,004	6	5,213	6
Omaha	1,512	1	1,427	2	1,166	...	....	...	...	..	....	...
Paterson	376	84	375	90	353	93	433	99	441	92	459	94
Pawtucket	55	192	45	182	36	149	....	...	....	...	....	..
Peoria	618	1	593	1	539	1	....	...	...	...	....	...
Philadelphia	2,459	107	2,240	127	2,040	130	1,897	132	...	...	....	...
Pittsburgh	2,825	231	2,378	222	2,001	229	1,738	210	1,457	205	1,120	173
Portland, Me	....	...	96	271	98	267	45	316	37	329	....	...
Portland, Oregon	....	.	640	6	510	4	....	...	...	...	..	...
Providence	535	627	404	654	337	646	322	675	340	944	324	616
Reading	174	156	167	152	164	160	104	240	145	184	147	233
Richmond	812	6	758	5	660	6	580	6	490	9	....	...
Rochester	....	.	567	99	....	...	....	...	....	...	....	...
San Antonio	503	4	....	...	....	...	....	...	....	...	....	...
St. Paul	927	151	698	194	...	..	469	210	....	...	....	...
St. Joseph	....	...	676	7	623	6	...	...	..	...	....	...
San Francisco	....	...	2,808	121	2,075	263	....	...	...	...	...	...
Scranton	109	186	....	...	87	184	84	168	69	164	....	...
Springfield, Ill	605	...	554	3	553	1	....	..	...	...	....	...
Springfield, Mass	...	...	61	196	51	190	41	162	52	145	....	...
Syracuse	....	...	....	. .	541	129	....	...	....	...	....	...
Toledo	1,064	23	977	18	936	17	....	...	....	...	....	..
Topeka	....	...	496	3	....	...	....	...	....	...	....	...
Utica	....	...	....	. .	551	36	....	...	....	...	....	...
Washington	769	350	466	475	524	331	478	300	444	270	292	314
Wilkesbarre	208	98	....	...	142	83	128	73	119	91	....	..
Williamsport	165	156	....	...	111	154	114	152	105	151	....	...
Wilmington	618	46	553	41	496	36	433	17	372	33	....	...
Worcester	....	..	54	323	72	253	57	215	78	192	88	185

Last year, reports from forty-eight exchanges showed 56,029 direct, and 6,271 circuit, while the forty-seven reporting on this point this year have 56,578 direct, and 5,409 circuit wires; the decrease in circuit wires not being as marked as in last year's table.

Only four exchanges, Pawtucket, Providence, Reading and Scranton, report more circuit than direct wires.

Table No. 10 is made up from the reports of forty-six exchanges, employing thirteen hundred and seventy-six operators.

TABLE NO. 10.

SALARIES OF OPERATORS.

46 Exchanges, 1,376 Operators.	Weekly Salary.
Highest (including Chief Operator)	$25 00
Lowest	1 10
Average	6 27

Detroit pays the highest salary, $25.00, and Nashville the lowest, $1.10.

Galveston shows the highest average, $19.29, and Reading the lowest, $3.92.

The general average is $6.27, last year it being $5.70.

Table No. 11 exhibits the pay of linemen and inspectors.

TABLE NO. 11.

SALARIES OF LINE AND INSTRUMENT MEN.

46 Exchanges, 297 Men.	Daily Pay of		
	Line Men.	Instrument Men.	Comb'n Men.
Highest	Omaha ... $3 25	Pittsburgh .. $2 88	Bridgeport.... $2 66
Lowest	Nashville, Detroit, 1 00	Dayton, Lincoln, .. 83	East Saginaw.. 96
Average	2 00	1 80	1 99

Tables Nos. 12, 13 and 14 relate to a feature of statistics, to which no attention has been paid in the reports of previous years, viz.: the extent to which metallic circuits are coming into use, both on subscribers' and on trunk lines.

Table No. 12 gives the number of metallic circuits and of grounded circuits now in use on subscribers' lines in 19 of the whole number of exchanges reporting, the remainder stating that they used grounded circuits exclusively.

TABLE NO. 12.

PROPORTION OF SUBSCRIBERS' METALLIC CIRCUITS.

Exchange.	Total Number Subscribers' Wires.	On Metallic Circuits.	On Grounded Circuits.
Albany	1,253	15	1,238
Boston	3,655	229	3,426
Bridgeport	336	22	314
Brooklyn	3,627	244	3,383
Danbury	150	8	142
Dayton	700	191	509
Denver	1,418	2	1,416
Hartford	411	49	362
Jersey City	729	69	660
Meriden	105	12	93
Newark	955	53	902
New Haven	631	131	500
New York	8,224	672	7,552
Paterson	460	30	430
Providence	1,162	25	1,137
Scranton	295	7	288
Waterbury	234	19	215
Wilkesbarre	306	4	302
Williamsport	321	2	319
	24,972	1,784	23,188

By an examination of this table, it will be noticed that in the 19 exchanges where metallic circuits are used at all, there are 1,784 metallic circuits out of a total of 24 972, being a little more than 7 per cent. of the whole, while if we take the 61,987 subscribers' wires used by all of the 47 exchanges reporting, the proportion is 2.8 per cent.

In making a complete statement as to metallic circuits, it is unfortunate that no report was received from Buffalo.

Six exchanges report a large number of subscribers connected on "common return wires." As they cannot properly be considered as metallic circuits, but the extent to which this device is employed being of interest, these reports have been grouped in a separate table, numbered 13.

TABLE NO. 13.

COMMON RETURN WIRES.

Exchange.	Total Number Subscribers' Wires.	On Common Return Wires.	On Grounded Circuits.
Atlanta	995	986	9
Des Moines	633	633	....
Louisville	1,818	500	1,318
Omaha	1,513	800	713
Richmond	818	818	....
Toledo	1,087	40	1,047
Total	6,864	3,777	3,087

It will be observed that these six exchanges have 3,777 subscribers' wires out of a total of 6,864, connected on common return wires, a proportion of 55 per cent.

Table No. 14 shows the use of the metallic circuit on trunk lines where they are naturally employed to a much greater extent. Out of 654 trunk lines in use in 22 exchanges, 271 are metallic and 383 grounded, while of 1,007 trunk lines used by all of the 47 exchanges reporting, nearly 27 per cent. are on the metallic circuit.

In this table is not included the great number of metallic circuits operated by the American Telephone and Telegraph Company, as that corporation has made no report. The statistics on this point, therefore, represent exchange lines only.

TABLE NO. 14.

METALLIC CIRCUIT TRUNK LINES.

Exchange.	Total Number Trunk Toll Lines.	On Metallic Circuits.	On Grounded Circuits.
Atlanta	2	1	1
Bay City	10	3	7
Boston	52	35	17
Bridgeport	13	10	3
Brooklyn	132	44	88
Danbury	3	3	...
East Saginaw	11	3	8
Hartford	24	16	8
Jersey City	73	23	50
Meriden	10	8	2
Newark	41	22	19
New Haven	16	13	3
New York	193	54	139
Omaha	13	5	8
Paterson	16	7	9
Providence	11	10	1
Richmond	2	2	..
Scranton	3	2	1
Waterbury	8	4	4
Washington	22	3	19
Wilkesbarre	5	2	3
Williamsport	4	1	3
Total	654	271	383

It will be interesting to compare the reports of next year with Tables 12, 13 and 14 as it is certain that the metallic circuit will one year hence be in much more general use.

UNDERGROUND WORK.

Last year, for the first time, statistics on underground work were called for, and this year ten exchanges have reported on this point, viz.: New York, Brooklyn, Boston, Pittsburgh, Detroit, Cleveland, Louisville, Washington, Milwaukee and New Haven.

Denver had no completed underground work at date of report, August 1st, but stated that it was expected to have 1,000 miles of Tile pipe conduits laid by August 15th, 1890.

In the 10 exchanges where underground construction has been commenced there are now 27,081 miles of underground conductors in use, 22,018 miles of which are made with the wires twisted in pairs, 18 per cent. of these being operated as metallic circuits, and 82 per cent. as single circuits, with the twin wire grounded.

New York naturally makes the greatest showing of underground conductors, viz.: 14,553.35 miles, Brooklyn being next with 3,768 miles, and Boston third, with 3,056 miles. Washington reports 1,500 miles; Pittsburgh, 1,091; Milwaukee, 1,047; Detroit, 870; Louisville, 468; Cleveland, 350, and New Haven, 288½ miles.

The longest underground conductor now in use is in New York, and is 29,069 feet, or 5½ miles long.

In answer to the question as to the age of the oldest underground conductor now in use, which has given satisfactory service since it was first put into use, it is reported from Pittsburgh that the same conductor mentioned in last year's report, which was laid June 26, 1882, is still in service, and working satisfactorily after 8 years and 2 months. Brooklyn reports one as in use 7 years and 4 months, Washington one, 6 years old, and several exchanges have underground conductors that have worked O. K. for more than 5 years.

Beside the 27,081 miles of underground conductors above mentioned as now in use, there are reported 3,648 miles more laid, not now in use, but available for use.

In answer to the questions regarding the failure of underground wires, only three exchanges, viz.: Boston, Brooklyn and New York report any cases of failures, the causes being given as follows:

"Damage by accident and from corrosion." (Boston.)

"Corrosion of pure lead pipe covering." (Brooklyn.)

"Mechanical injury." (New York.)

Regarding conduits, the first one was laid in Pittsburgh in June, 1882. It was a "wooden box filled and covered with pitch." The next was laid in Boston in October of the same year, and was of "iron pipe in concrete." Other styles are reported as follows:

"Dorsett."

"Creosoted wood."

"Vitrified clay pipe."

"Patent cement-lined iron pipe."

The present condition of all the conduits is reported as good, except the Dorsett, which is said to be "fairly good since being repaired where it was undermined, broken and damaged from other causes."

In conclusion, the Secretary desires to thank the officers of the companies which have made the reports from which this one is compiled, and to say that the reports received this year have been more complete than ever before, and more carefully made out.

Respectfully submitted,

C. H. BARNEY,

Secretary.

MR. CRANDELL—As a motion to adjourn is now in order, and, while it may seem a little premature, I think we have received such assurances from our hospitable hosts (and from the manner in which we have been entertained and are going to be still further entertained) that I desire to offer a vote of thanks both for what we have received and for what we are about to receive. [Laughter and applause.]

MR. E. J. HALL, JR.—I second that motion.

The motion was carried unanimously.

On motion the convention adjourned *sine die*, at 12:45 P. M.

The next meeting of the Association will be held at New Orleans, La., at a date to be hereafter decided upon by the Executive Committee.

APPENDIX A.

Hospitalities Extended to the Members of The National Telephone Exchange Association while in Detroit.

The Michigan Telephone Company and the Telephone and Telegraph Construction Company, through Mr. W. A. Jackson and Mr. F. A. Forbes, treated the visiting telephonists most handsomely. Wednesday afternoon all were taken on a drive about the beautiful City of Detroit and through Bell Isle Park, and in the evening an elaborate banquet of 100 plates was served at the Russell House. A number of toasts were wittily responded to at the end of the banquet, remarks being made by Messrs. Sargent, Tyler, Storke, Gifford, E. J. Hall, Jr., Crandell, Lockwood, Barney and others. A feature of the after-dinner entertainment was the singing by the Electrical Choir, under the leadership of the one and only A. S. Hibbard.

Thursday afternoon the fine steamboat "City of Detroit" took all the visitors up the lake to the St. Clair flats, the ride being particularly enjoyable. A lunch, which was a perfect one, was served during the trip.

In all the many details that go to make up perfect entertainment of a large party, the arrangements planned by Messrs. Jackson and Forbes have never been excelled, and these gentlemen were almost overcome with the shower of thanks and cheers they received as they were bidden good-bye.

The Detroit Convention will long be remembered as one of the most enjoyable social events of telephone history.

Among the ladies present at the Convention were: Mrs. A. O. Morgan, Boston; Mrs. R. M. Bailey, Williamsport, Pa.; Mrs. H. C. Palmer, New York; Mrs. John N. Culbertson, Buffalo, N. Y.; Mrs. W. J. Cole, Atlanta, Ga.; Mrs. A. W. Crandell, New Orleans, La.; Mrs. C. H. Barney, New York; Mrs. H. L. Storke, New York; Mrs. J. P. McKinstry, Cleveland, O.; Mrs. W. N. Eastabrook, Elmira, N. Y.; Mrs. F. G. Beach, Chicago; Mrs. J. E. Zeublin, Columbus, O.; and Miss Gifford, Louisville, Ky.

APPENDIX B.

OFFICERS FOR THE YEAR 1890–1891.

President.

WILLIAM D. SARGENT, - - Brooklyn, N. Y.

Vice-President.

FRANK G. BEACH, - - - - Chicago, Ill.

Secretary.

C. H. BARNEY, - - - - New York City.

Treasurer.

HENRY L. STORKE, - - - New York City.

Advisory Committee.

For three years—W. A. JACKSON, Detroit, Mich.
For two years—A. W. CRANDELL, New Orleans, La.
For one year,—MORRIS F. TYLER, New Haven, Conn.

Executive Committee.

WM. D. SARGENT, *Ex-Officio*, - - Brooklyn, N. Y.
CHARLES F. CUTLER, - - New York City.
CHARLES H. WILSON, - - - Chicago, Ill.
H. N. GIFFORD, - - - - Louisville, Ky.
EDWARD J. HALL, SR., - - - Buffalo, N. Y.

APPENDIX C.

ROLL OF ACTIVE MEMBERS.

SEPTEMBER 11, 1890.

American Telephone & Telegraph Co., New York City.
Bell Telephone Co. of Buffalo, Buffalo, N. Y.
Bell Telephone Co. of Missouri, St. Louis, Mo.
Bell Telephone Co. of Philadelphia, Philadelphia, Pa.
Central District & Printing Telegraph Co., Pittsburgh, Pa.
Central Pennsylvania Telephone & Supply Co., Williamsport, Pa.
Central Union Telephone Co., Chicago, Ills.
Chicago Telephone Co., Chicago, Ills.
Colorado Telephone Co., Denver, Col.
Chesapeake & Potomac Telephone Co., Washington, D. C.
Central New York Telephone & Telegraph Co., Utica, N. Y.
Cumberland Telephone & Telegraph Co., Nashville, Tenn.
Delaware and Atlantic Telephone & Telegraph Co., Philadelphia, Pa.
Empire State Telephone & Telegraph Co., Auburn, N. Y.
Erie Telephone & Telegraph Co., Lowell, Mass.
Great Southern Telephone & Telegraph Co., New Orleans, La.
Hudson River Telephone Co., New York City.
Metropolitan Telephone & Telegraph Co., New York City.
Missouri & Kansas Telephone Co., Kansas City, Mo.
Michigan Telephone Co., Detroit, Mich.
Nebraska Telephone Co., Omaha, Neb.
New York & New Jersey Telephone Co., Brooklyn, N. Y.
New York & Pennsylvania Telephone Co., New York City.

New England Telephone & Telegraph Co., Boston, Mass.
Ohio Valley Telephone Co., Louisville, Ky.
Pacific Bell Telephone Co., San Francisco, Cal.
Providence Telephone Co., Providence, R. I.
Pennsylvania Telephone Co., Harrisburg, Pa.
Rocky Mountain Bell Telephone Co., Salt Lake City, Utah.
Southern Bell Telephone & Telegraph Co., New York City.
Southern Massachusetts Telephone Co., New Bedford, Mass.
Southern New England Telephone Co., New Haven, Conn.
Wisconsin Telephone Co., Milwaukee, Wis.

ASSOCIATE MEMBERS.

American Electrical Works, Providence, R. I.
Felton & Guillaume, Köln, Germany.
National Conduit Manufacturing Co., New York City.
Standard Electrical Works, Cincinnati, Ohio.
Western Electric Co., Chicago, Ills.

HONORARY MEMBERS.

American Bell Telephone Co., Boston, Mass.
Bell, A. Graham, Washington, D. C.
Bell Telephone Co. of Canada, Montreal, Can.
Bridgeport Brass Co., Bridgeport, Conn.
Beetle, Geo. L., New York City.
Berthon, A. F., Paris, France.
Childs, W. A., New York City.
Cheever, Charles A., New York City.
Cassidy, John, Honolulu.
Dana, R. K., New York City.
Electrical Supply Co., New York City.
Lockwood, Thomas D., Boston, Mass.
Maynard, George C., Washington, D. C.
Madden, O. E., New York City.
Phillips; E. F., Providence, R. I.

Potter, F. I. Pittsfield, Mass.
Pope, H. W., New York City.
Sawyer, W. H., Providence, R. I.
See, I. W., Cincinnati, O.
Utica Fire Alarm Telegraph Co., Utica, N. Y.
Vail, Theodore N., New York City.
Williams, Jr., Charles, Boston, Mass.
Wiley, George L., New York City.
Lemon C., Wellington, New Zealand.

APPENDIX D.

CONSTITUTION.

ARTICLE I.—NAME.

The name of the Association shall be "THE NATIONAL TELEPHONE EXCHANGE ASSOCIATION."

ARTICLE II.—OBJECT.

This Association is formed for the purpose of collecting, preserving and protecting all matters of importance to telephone interests.

ARTICLE III.—MEMBERSHIP.

1. The members of this Association shall be such companies or individuals as hold exchange licenses or authority from the American Bell Telephone Company; and in the meetings of the Association each member shall be entitled to one vote for each exchange operated by such company or individual, but there shall be but one exchange within the corporate limits of any city or town entitled to a vote.

2. Such companies or individual licensees attending the first meeting for the organization of the Association are hereby declared to be members thereof, provided they shall pay the admission fee and subscribe to this constitution, or otherwise in writing notify the Secretary of their acceptance of membership on or before January 1, 1881.

ARTICLE IV.—OFFICERS.

1. The officers of this Association shall be a President, Vice-President, Secretary, Treasurer, and Executive and Advisory Committee, who shall, with the exception of the Secretary and the members of the Advisory Committee, be elected at each annual meeting of this Association, and shall hold office for one year, or until their successors are duly elected and qualified. The Secretary shall be appointed, for the ensuing year, by the newly-elected Executive Committee.

ARTICLE V.—PRESIDENT.

The President shall preside at all meetings of the Association, and is *ex-officio* Chairman of the Executive Committee.

ARTICLE VI.—Vice-President.

The Vice-President shall, in the absence or inability of the President, act as President of the Association.

ARTICLE VII.—Secretary.

The Secretary shall keep a record of the proceedings of all the meetings of the Association, conduct the correspondence, with the concurrence of the President, and discharge such other duties as shall be required of him by the Association.

ARTICLE VIII.—Treasurer.

The Treasurer shall collect and disburse the moneys of the Association, and shall give security in such sum and in such form for the faithful performance of the duties of Treasurer as shall be required by the Executive Committee.

ARTICLE IX.—Executive Committee.

1. The Executive Committee shall consist of five members, three of whom shall constitute a quorum for the transaction of any business.

2. This Committee shall be vested with the power of trustees as far as the affairs of this Association are entrusted to their charge by the provisions of the Constitution and By-Laws, and no further.

3. It shall submit to the Association a written report of its doings at each meeting of this Association.

4. It shall receive from the Secretary and transmit to the Association all applications for membership, together with its report thereon, in writing, and said Committee may admit or reject during the intervals of meeting any application so received, subject, however, to approval or disapproval of this Association at its next meeting, and the action of this Committee shall not be final, but advisory only, in reference to such application.

5. The only salaried officer of this Association shall be the Secretary, whose compensation shall be fixed by the Executive Committee from time to time.

ARTICLE X.—Advisory Committee.

1. An Advisory Committee of three shall be elected at the first meeting of the Association, one for three years, one for two years, and one for one year; and one member shall thereafter be elected at each annual meeting for the term of three years.

2. It shall be the duty of this Committee to consider and report to the Association such amendments to the Constitution and By-Laws as in their opinion will best further the aims and purposes of the Association.

3. The Committee may also hear, at their discretion, any specific complaint which may be made to them by any member of the Association in writing, affecting telephone interests, and shall report thereon to the Association with such recommendations as it may deem advisable.

4. It may also consider any questions touching the interests of the members of this Association that may be referred to it, and may call for papers or other documentary evidence in their possession which the majority of said Committee may deem necessary for the information of such Committee in making such examination and compiling a report thereon. A refusal by any member of this Association to furnish such papers and information as may be called for shall cause his immediate suspension until restored by a majority vote of the members of the Association present. Members of this Association suspended by the Advisory Committee shall be entitled to all the rights and privileges of members on any question affecting their membership until the final adjudication of the question by the Association.

5. The Treasurer shall honor, as far as the funds in his hands will permit, drafts made upon him by the Secretary and countersigned by the Chairman of the Advisory Committee, in payment of expenses of such Committee in obtaining information desired and incident to the proper performance of the duties of such Committee.

ARTICLE XI.—Other Committees.

The Association may provide in its By-Laws for other Committees, but no matter shall be referred to a Special Committee which is relevant to the functions of any Standing Committee.

ARTICLE XII.—Liabilities.

No officer, or Committee, or other persons, shall have any power to make the Association liable for any debt amounting to more than one-half of the money in the Treasurer's hands beyond that required to meet prior liabilities.

ARTICLE XIII.—Meetings.

1. The Association at its annual meeting, by a two thirds vote of the members present, shall designate the time and place of the next annual meeting.

2. Special meetings of the Association may be called by the President, or Advisory Committee of its own motion, and shall be called by the Secretary upon the request of twenty members of the Association, in writing, signifying the purposes thereof, and the Secretary shall give notice of such special meeting to each member of the Association, by mailing a written or printed notice thereof, at least thirty days prior to said meeting, to the last known post-office address of such members.

ARTICLE XIV.—Fees.

1. The admission fee shall in all cases be ten dollars, to be paid on signing the Constitution. The annual dues shall be fifty dollars for each vote now had or that may be hereafter acquired under the Constitution, and shall be payable yearly on or before the first day of October in each year for the year ending August 31st, thereafter.

2. The Association may, by resolution adopted by a majority of all the voters of the Association, make assessments on the members thereof, and such

assessments shall be uniform and equal, and on the basis of the number of votes to which each member may be entitled at the time such assessments are made, and representatives may vote either in person or by proxy.

ARTICLE XV.—Expulsion.

Any member may be suspended or expelled for misconduct or other sufficient cause after conviction thereof, by a two-thirds vote of the members of the Association present at any regular meeting.

ARTICLE XVI.—Amendments.

1. This Constitution shall go into effect immediately.

2. It can be amended only by a two-thirds majority of the votes cast therefor at a meeting of the Association held after notice of the proposed change.

3. Notice of such proposed change should be given by filing with the Secretary, at least sixty days before the meeting at which such proposed change is to be acted on, a copy of the section as it will read when modified as proposed, and the Secretary shall immediately thereafter transmit a copy of such notice to the post office address of each member.

ARTICLE XVII.—Honorary Membership.

1. Any person nominated by the Executive Committee may become an honorary member of this Association by a vote of two-thirds of all the members present at any regular meeting, such elections to be by ballot.

2. An honorary member shall have no vote in the meetings of the Association, and shall be subject to no dues or assessments.

ARTICLE XVIII.—Associate Membership.

1. Any person or corporation actively interested in the objects of this Association may become an associate member of the Association by a vote of a majority of the members present at any regular meeting.

2. An associate member shall have no vote in the meetings of the Association, but shall be entitled to all the other privileges of regular members, except during executive sessions, and shall be subject to the same dues and assessments.

APPENDIX E.

BY-LAWS.

ARTICLE I.—Election of Officers.

The officers of this Association shall be put in nomination by the Association, and elected by ballot at each annual meeting of the Association.

ARTICLE II.—President.

The President shall, in addition to his duties as prescribed by the Constitution, sign all warrants or orders drawn by the Secretary on the Treasurer.

ARTICLE III.—Secretary.

1. The Secretary shall keep an accurate roll of officers and members, and notify officers and members of committees of their election or appointment.

2. Shall issue notices of all meetings of the Association, with a brief note in case of special meetings of the object for which they are called; and shall keep correctly the accounts of the Association, and at each annual meeting submit a written report of the doings of his office to the Association.

3. Shall draw and sign all drafts or orders on the Treasurer, transmitting a brief memorandum of the nature of the expenditure to the Treasurer at the date of such draft.

4. Shall transmit to the Chairman of the Executive Committee all applications for membership upon their receipt by him, make a proper entry of their receipts and disposal upon the records of the Association, and upon the unanimous report of said committee, upon such application being filed in his office, shall at once transmit a conditional certificate of membership to such applicant, which shall entitle said applicant to all the privileges of membership until the next meeting of this Association.

5. Shall, under the direction of the Executive Committee, procure and compile for the use of the Association such statistics relating to the telephone business as have heretofore been furnished by the various committees of this Association.

ARTICLE IV.—Treasurer.

1. The Treasurer shall keep an accurate roll of the members, and shall collect, and under the direction of the Executive Committee and other specially empowered committees, expend, deposit or invest the funds of the Association.

2. Shall keep regular books of accounts, which shall be opened to inspection by any member of the Executive Committee.

3. Shall report in writing to each regular meeting of the Association, and to the Executive Committee, as and when requested by them, the financial condition of the Association.

4. His report at each annual meeting of the Association shall contain a statement of the receipts and disbursements for the year, and of the outstanding obligations, and an estimate of the resources and expenditures for the ensuing year, and his accounts shall be at all times subject to examination and approval by the Executive Committee.

ARTICLE V.—Committees.

1. The Executive Committee may hold its meetings whenever a majority of its members, or the President of the Association, shall deem it for the interests of this Association to do so, upon ten days' notice by mail being given to each member of the time and place of holding such meeting, such notice being signed by either a majority of the members of said Committee, or by the President of the Association. The Committee shall keep a systematic record of all its proceedings, and shall meet on the day preceding each annual meeting of the Association. It shall, upon the receipt of a proposition from the Secretary, transmit a copy of such proposition to each member of said Committee, who will, in case it is not deemed expedient to hold a meeting of said Committee, indorse his approval or disapproval upon said copy and return the same to the Chairman, who shall at once file the same, as a part of his report, with the Secretary.

2. The Advisory Committee shall choose from their number a Chairman, and shall keep a record of all its proceedings, and upon receipt of a complaint in writing, properly stated, proceed to thoroughly examine the same and report its action. The provisions with reference to the meetings of the Executive Committee shall apply to the meetings of this Committee.

ARTICLE VI.—Membership.

Whenever hereafter any company or individual desires to become a member of this Association, it shall by resolution, at a regular meeting of its Board of Directors, make application for membership, and shall forward a copy of such proceedings properly attested by the corporate officers and seal of said corporation, together with the admission fee, to the Secretary of this Association, when such proceedings shall be had as are heretofore indicated in Articles II. and V., subject, however, to such action as this Association may at its next regular meeting take in either accepting or rejecting said proposition when, if the application is rejected, the applicant will be notified by the Secretary.

ARTICLE VII.—Non-payment of Dues.

If any member fails to pay the yearly dues or assessments within one month from the first day of October, when the same become payable, it will be the duty of the Treasurer to mail such member a copy of this By-Law and notice, that unless the same are paid within one month thereafter, the default will be

reported to the Executive Committee; which may by order, without further notice, cause the name of such member to be stricken from the rolls, and such membership and all rights in respect thereof will thereupon cease. But upon written application, satisfactorily explaining the default, and upon payment of all dues to the date thereof, the Executive Committee shall have power to remit the penalty of this By-Law and restore the membership.

ARTICLE VIII.—Amendments.

These By-Laws may be amended at any regular or called meeting by a vote of the majority of all the votes represented at such meeting, provided that thirty days' previous notice in writing shall have been given to the Advisory Committee, and also to the Chairman of the Committee (if any) affected thereby.

ARTICLE IX.—Suspension of Rules.

These rules may be suspended at any meeting of the Association by a majority of all votes represented at such meeting.

ARTICLE X.—Statistical Committee.

At each annual meeting there shall be appointed by the President a General Committee on Statistical Information for the ensuing year, of which the Secretary shall be *ex-officio* chairman. The number of members of this Committee shall be determined from year to year by the President, according to the amount of assistance required by the Secretary, and it shall be their duty to render the Secretary such aid in the preparation and classification of information for presentation to the Association as he may require.

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TWELFTH MEETING

OF THE

NATIONAL

TELEPHONE EXCHANGE

ASSOCIATION,

HELD AT

The Russell House, Detroit, Mich.,

September 9th and 10th, 1890.

BROOKLYN:
EAGLE BOOK AND JOB PRINTING DEPARTMENT.
1890.